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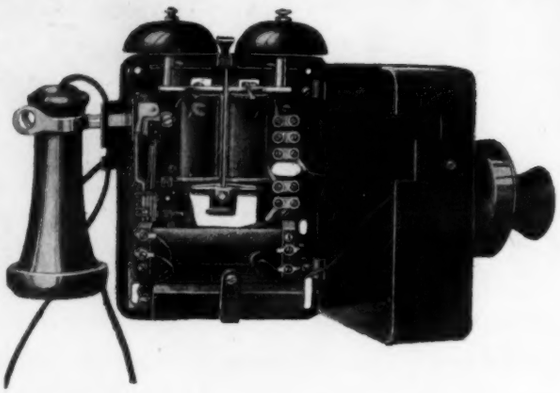

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A Summer Resort Convention

THE announcement that foots this page, giving the location of the next national Independent convention as Winona Lake, Indiana, carries to the telephone man's eye an unfamiliar element. Previous national meetings, with the possible exception of the informal affair at Niagara Falls in 1909, have been confined to big cities. Secretary Vivian's explanation that city hotels this season will be too crowded, too indifferent, and too profiteerial, is logical and to the point. But as to an excuse for taking the conventioners to the country, none is needed. The American Institute of Electrical Engineers, to mention just one technical deliberative body of considerable strength, has been taking its summer sessions to lakes and mountains and sea beaches for a number of years. The members seem to like it. Our observation is that both city men and country men prefer the country for a pleasure trip, and a convention's pleasure features are not its least valuable element.

The convention dates are June 15, 16, 17 and 18, which gives us time for a fuller description of the event next month; but it is to be noted that the association secretary wants room reservations now. They can be canceled later, if emergencies arise, more easily than they can be made later.

The Metric System

FEW intelligent persons will deny the obvious advantages of the metric, or decimal, system of weights and measures. Certain business men and engineers are so enthusiastic about it that Congress is being asked to make its adoption in this country compulsory. Without further analysis, there appears little objection to such a course. But within the past few weeks the American Railway Engineering Association and the National Automobile Chamber of Commerce both have adopted resolutions opposing the plan.

The telephone operating industry is not based upon accurate measurements to the degree that marks the railroad operating industry. The telephone manufacturing business is not so dependent upon standardized gauges as is the automobile manufacturing business. No such interest in the metric question is manifest in the telephone field as the other lines mentioned have displayed. Nevertheless, compulsory changes in all the present standards of measurement would have their certain effect. Talk of line wires and cables in kilometers, of poles in meters, of jack spacing in millimeters, and of bulk supplies by the kilogram, surely would be a bit trying for a time, however satisfactory eventually. Just how annoying or valuable the change would actually be is a matter well worth studying. We would like to hear from our readers on the subject.

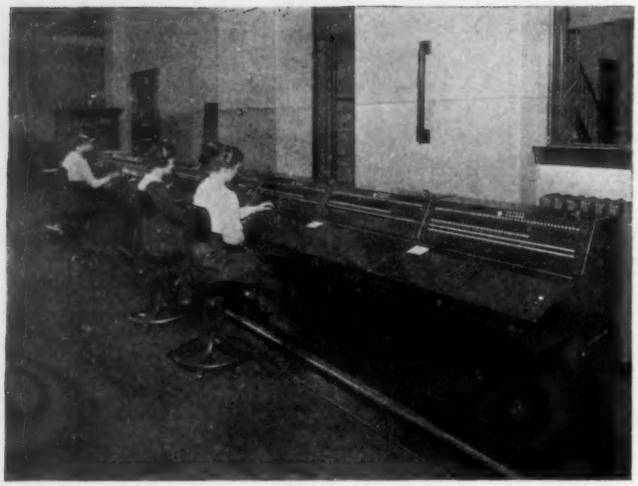
Groceries By Telephone

EVERY little while some lecturer on the popular subject of current prices, generally a college professor, attacks the habit of ordering groceries and meats by telephone as the secret cause of the high cost of living. Seldom is an argument presented in public that is so obviously false on the face of it. Anyone who has watched the telephone order clerk in a modern store handle customers, and is possessed of any imagination at all, surely must have visualized the veritable army of counter clerks that would be required to wait upon those same customers in person. The business man, observing this mental picture, will be quick to extend his visualizing to the payroll, and think of the wages to be paid to those counter attendants, as compared with the wage of one operator and the rental of a telephone.

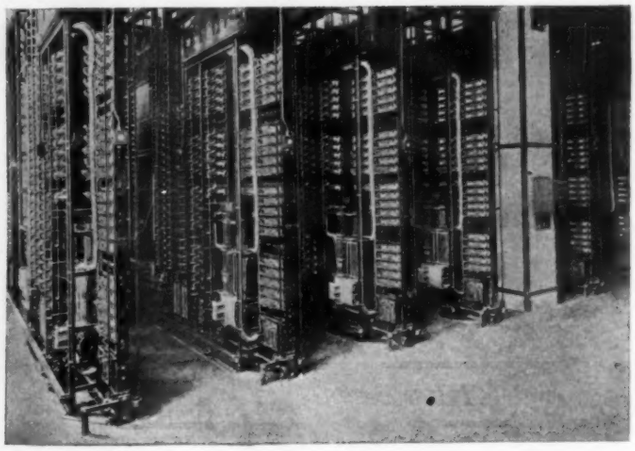
And that same grocer's telephone does still more. It enables him so to extend his trade that his list may mount to thousands of patrons, who are all served with dispatch and accuracy and economy in quarters that would not accommodate one-tenth of their number on the market-basket plan.

The Regular Annual Convention of the United States Independent Telephone Association

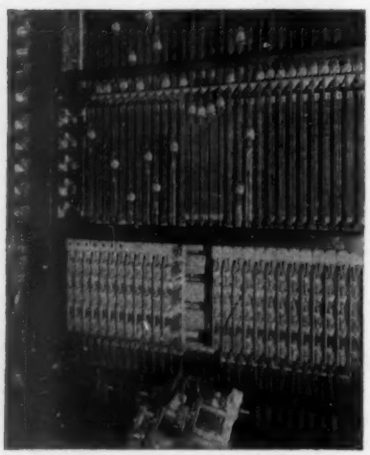
Will Be Held at Winona Lake, Indiana, June 15, 16, 17 and 18, 1920. Make Your Reservations Now!



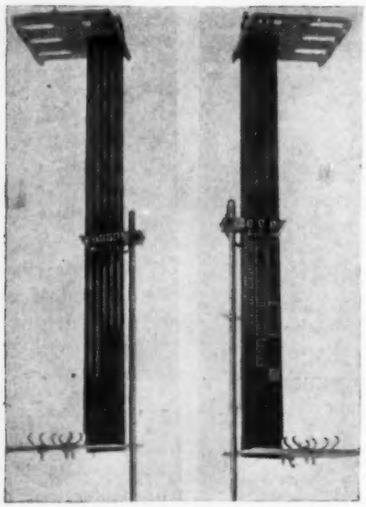
Typical Installation of Cordless B Positions in a Machine Switching Office —Fig. 12 in the Article.



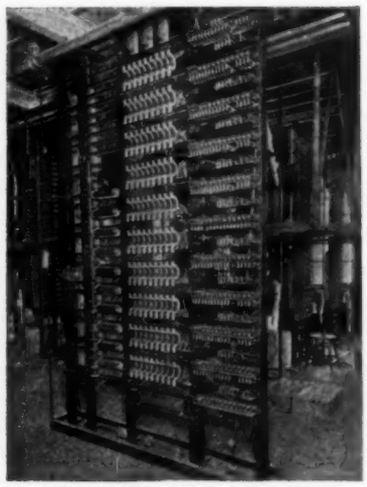
General View of Machine Switching Installation—Fig. 11 in the Article. Article.



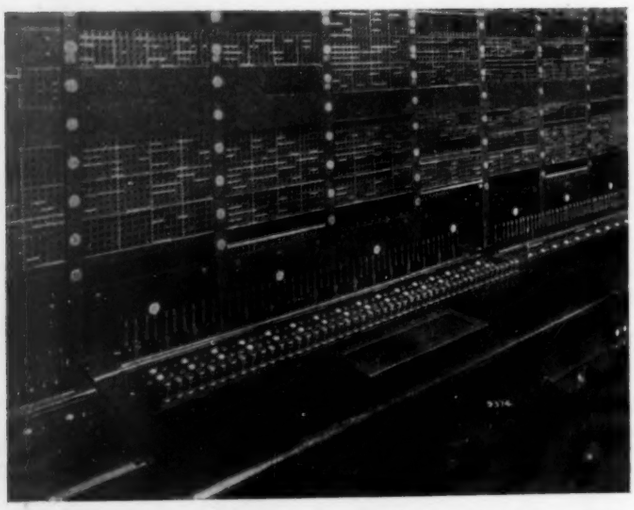
Section of Selector Frame with Brushes in Various Positions—Fig. 4 in the Article.



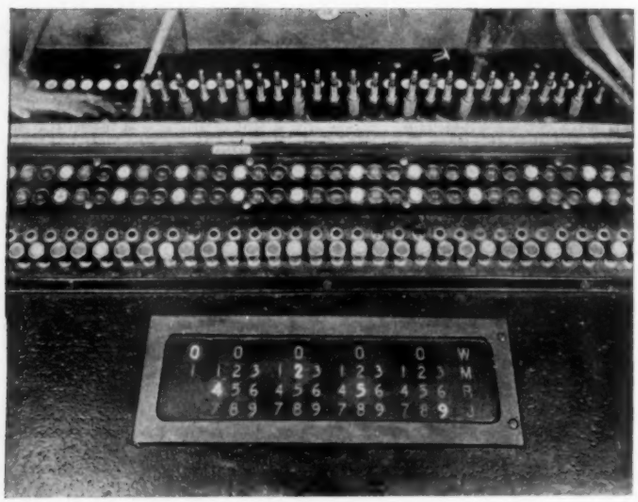
Impulse-Making Commutator and Brush in Detail—Fig. 6 in the Article.



Sender Frame, Carrying Sequence Switches, Relays, and Small 22-Point Selecting Switches—Fig. 8 in the Article.



Operator's Position in Manual Office Arranged to Complete Calls Originating in Mechanical Office—Fig. 13 in the Article.



Detail of Call Indicator on Manual Board, with Illuminated Letters and Numbers—Fig. 14 in the Article.

Machine Switching in the Bell System—See Page 23.

Tractors Plant Telephone Poles

Tanklike Machine Carries Earthborer, and Sets Sticks in a Hurry

EVERY day brings forth some new and ingenious method by which machine power is applied to take the place of manual labor. Here is illustrated one of the most interesting of these developments. It is a combination of tractor and earth-boring machine, which digs a hole and sets up a telephone pole in about eight minutes.

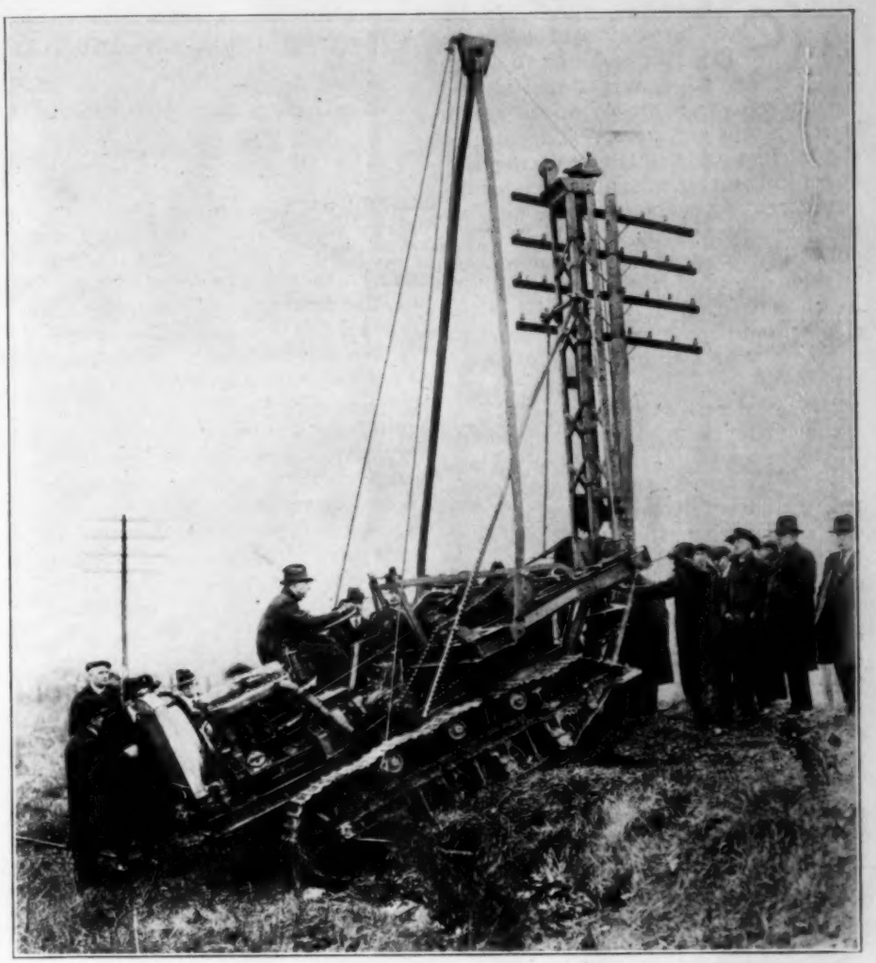
It is not so very long ago that the creeper type tractor, such as the Monarch machine illustrated herewith, was first introduced for farm work. The irresistible grip on the ground made possible by the Monarch tracks was utilized by the government during the war as the traction principle for tanks, and we now find this traction principle with the rugged power which has proven so useful to the farmer, being used by telephone companies to offset the shortage of labor.

The earth-boring machine is mounted on the frame of the tractor, which carries it up steep embankments, over railroad tracks, and in fact over any obstacle that may be encountered in an ordinary day's travel.

When the spot at which the pole is to be erected is reached, the power from the Monarch tractor engine is switched to the earth-boring machine. This, in reality, is a giant augur which will bore a hole in the ground any size from two inches to 30 inches in diameter, and as deep as eight feet.

When the hole is bored, the steel tower in which the augur is contained is then used as a crane to lift the pole and set it in position.

The whole operation is remarkably expeditious, and is obviously so marked a step forward in the first action of pole-line construction that once it is seen at work, the manual process ordinarily used seems incredibly slow and awkward, and not to be considered for modern undertakings.



The Tractor-Earth Borer in Action, Setting a Pole in the Hole It Has Bored.

Omaha to Use Wireless Telephones

A wireless telephone exchange which will enable users of the ordinary telephone to communicate with all parts of the world, as well as with ships and aircraft, will be installed in Omaha, in the near future, according to Dr. Frederick H. Millener, Omaha physician and surgeon, and one of the pioneers in the development of the wireless telephone.

Six wireless telephones were received at Fort Omaha for balloon service, and although they are not of the type which enabled Robert F. Gowen, of New York, to talk 30 minutes with R. H. G. Mathews in Chicago, they are the most up-to-date instruments yet received in Omaha, according to Dr. Millener.

"The installation of such service is not only practical and possible, but is inevitable," Dr. Millener declared yesterday. "It will be only a short time until every person in Omaha who has a telephone will be able to take up the receiver, get the wireless exchange and talk to any city or ship which he desires.

"He will find that there is little delay in the work of the wireless telephone, and that he will get fewer wrong numbers. And when he gets his party he will hear as plainly and feel the same sense of being connected with the party as he does now with the wire telephone. There will be nothing complicated about the system. The operator simply will place the plug in the right slot and the connection will be made."

In prophesying the early installation of wireless telephones in Omaha for commercial purposes, Dr. Millener explained that since the war the development of the instrument has been more rapid than was anticipated.

"When I was experimenting with the instrument at the Union Pacific headquarters my equipment weighed 500 pounds," said Dr. Millener. "Now it weighs only 50 pounds."

European Telephone Practice

Translations from the Foreign Press and Communications from European Engineers

By FRED W. SCHOLZ

Multiplex Telephony and Telegraphy

ATTEMPTS to transmit several telegraphic messages or to carry on several conversations simultaneously over a set of wires reach back a number of years. The fundamental idea consists in replacing the direct current source in the sender by an alternating current source, making the length of periods very short. The possibility to send several messages at the same time is given by the ability to tune each of the receiving instruments in some way, whether electric or acoustic, to agree with one of the frequencies used, so that only the messages sent out with the definite frequency used can be understood. The advantages of such a method are obvious, since we can multiply the capacity of the telephone system, if we can send perhaps five messages over the same wire, where previously we could send only one message.

In view of the importance of such a development in telephone equipment, it is no wonder that large numbers of attempts were made to bring about the desired results. Most of the attempts remained on paper, however, being impossible to carry through in practice. The oldest and most practical attempt for the time being was that of Mercadier. He

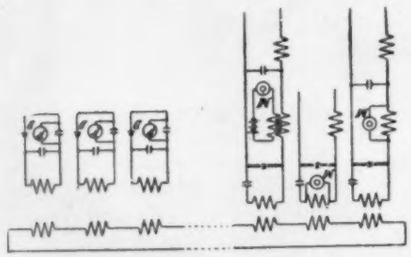


Fig. 1. Ruhmer System of Multiplex Telephony.

used alternating currents of a frequency to bring forth a good, clear tone over the telephone receiver. The telephone instrument is tuned acoustically to agree with one of the a. c. frequencies. However, the method was not adopted to any large extent, being soon displaced by the more efficient telegraph tickers and multiplex telegraph instruments.

The progress made by wireless telegraphy within the last few years also gave new and better methods of producing and receiving high-speed alternating currents. The favorable results obtained in producing alternating currents whose frequency lay above the limit of audibility brought the problem of multiple telephony nearer to practical realization. One of the first attempts to take advantage of this development was made by E. Ruhmr. For a. c. sources he used Poulsen arc lamps and for the receiving instruments he used tuned circuits, as was done in wireless telegraphy. He succeded enough to carry on three simultaneous conversations over a short-length experimental line. The diagram for the wiring necessary for Ruhmer's system is shown in Fig. 1.

A further step was then made in 1911 by Major G. O. Squier in Washington, who made practical and successful tests over a telephone line of 7-mile length. For current source Squier used an Alexanderson a. c. generator for frequencies between 20,000 and 100,000 periods per second. The results of his experiments were so encouraging that various continental countries saw great possibilities in the multiplex system and set their own government testing laboratories to work on this problem. In the year 1912 the German government requested its telegraph and telephone testing station to study the multiplex system and extensive investigations were undertaken in the years immediately preceding the war.

Profiting by the successful experiences of Mercadier and Squiers, they succeeded without trouble in constructing an experimental line on which at least two conversations could be carried on at the same time. One of these conversations was carried on over the ordinary telephone set, the other over a special high-frequency set. As current source a Poulsen arc light was used. This system was not suitable for practical purposes, however, because the arc lamp is not a very reliable generator and requires constant attention. In further tests it was replaced by an a. c. current generator. The fundamental frequency of this generator was 6,400 periods per second. By suitable means it was possible to increase the frequency to 19,000 and 32,000 periods per second.

The tests were then extended to paper-insulated cables of various types. Communication was possible on cable length up to 8 miles distance. To change the high-frequency currents back to ordinary telephone

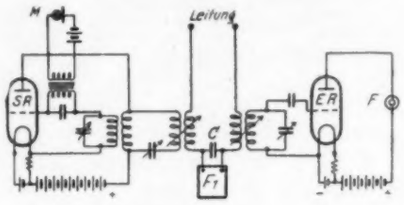


Fig. 2. Fassbender and Habann System of Multiplex Telephony.

currents a Lieben tube connected by the audion system was used. These experiments were interrupted by the war, but were taken up again in 1915 and carried on until 1917. At this time a new arrangement was used in the shape of high-vacuum cathode tubes for production and for receiving the rapid alternating currents, also for amplifying the telephone currents. The first experiments were made on single-wire telephone lines. It was shown, however, that the high frequency currents had a strong influence on neighboring lines and that they were considerably damped.

After this the usual double wire telephone lines were used for the tests. The cathode tubes used for generators had a 2.2-ampere current, 220-volt anode tension and frequencies of 10^5 to 10^6 periods per second (wave lengths between 3000 and 300 meters), giving an oscillation capacity of nearly 1 watt. The microphone was connected into one of the oscillation circuits. When speaking against the microphone the strength of the high frequency oscillations changes and keeps in rhythm with the telephone currents. When using overhead wires up to 3 mm. thickness conversations could be carried on to distances of 60 miles.

During the summer and fall of 1918 the army demanded a simple and practical development of the multiplex system, and the equipment developed by Fassbender and Habann was shortly after adopted by the German army authorities. The diagram

is shown in Fig. 2, where M is the microphone, F the long distance telephone receiver for the conversation to be carried on with the aid of high speed alternating currents.

The sender tube SR generates the necessary oscillations in the so-called Meissner connecting system, used for the telephone equipment. The receiving tube ER is connected like an ordinary audion. An apparatus F_1 can be connected parallel to the block condenser for a second conversation. The cathode tubes in the sender and the receiver are small Telefunken amplifier tubes with 0.6-amperes heating current and 90-volt anode feed current. The sender gives oscillations of about 0.05 watt. Using a wave length of 600 to 700 meters, conversation was carried on over a 3-mm. copper telephone line for a distance of 30 miles. The results achieved with this simple system were satisfactory for limited army use, but required further development if to be employed for commercial communication. After the signing of the armistice, the authorities, in spite of chaotic political conditions, asked the telegraph testing station to proceed with the tests, and this was done in connection with the Telefunken Company, which is the largest wireless-telegraph company in Germany. The tests were carried on over an overhead 3-mm. copper line of 180-mile length, running between Hanover and Berlin. The purpose was to try out multiplex telephony on a line actually in use and not merely on an artificial experimental line, and to develop the system far enough to show its practical advantages and possibilities for commercial use.

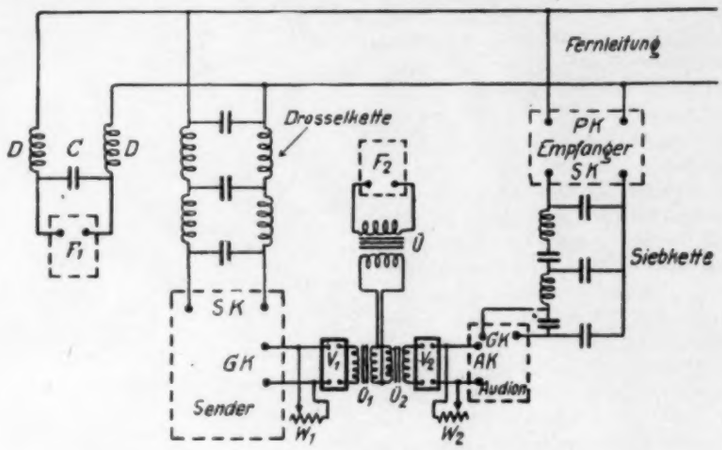


Fig. 3. New German Multiplex System.

Multiplex Telephone Tests:—The experiences in former tests made it advisable to use slower oscillations and to increase the transmission capacity. The experiments were therefore carried on with a tube sender of 10-watt oscillation capacity and with frequencies down to 15,000 periods per second (20 km. wave length). With these means it was easy to bridge the distance of 180 miles without trouble. Under these conditions there is needed, for each a. c. conversation, at each conductor terminal one a. c. transmitter and also one receiver. For n—— number of conversations over the same wire there are needed $2n$—— number of transmitters and just as many receivers. Each sending instrument has a definite frequency.

In order to test the new process thoroughly it seemed sufficient to make arrangements for only two simultaneous conversations to be carried on at the same time by means of the ordinary telephone equipment and the new a. c. equipment. Under these conditions there was a possibility of finding out the difficulties that would arise when trying to carry on a larger number of conversations. Speaking generally on the basis of past experience, it seems that there is no reason why a larger number of conversations could not be carried on besides the three conversations which were carried on with success on the line under test. The number of conversations that can be carried on over the same set of wires depends no doubt on the useful wave lengths that can be employed for the purpose.

When working out the new system the following points had to be kept in the foreground at all times. The equipment needed for a. c. telephony must be restricted to long distance telephony. The subscriber must be able to use the instruments at his disposal for the ordinary conversation, and must be connected to the long-distance switchboard at the exchange by the usual methods. The systems known so far for multiplex telephony do not meet this demand entirely, or at least only to a very limited extent. A practical use of multiplex telephony is however based on the above assumption, as it would not be an economical proposition to be obliged to scrap a lot of the present long-distance equipment and to replace it by new equipment.

Fig. 3 shows the complete wiring diagram for the multiplex system developed by the German testing station. For the sake of simplicity, the diagram has been restricted to the use with only one a. c. telephone conversation carried on simultaneously with the conversation over the ordinary telephone equipment. The equipment needed for other conversations must be thought to be connected parallel to the first one on the long distance line. F_1 in the figure represents the connection for the conversation to be carried on by the usual means.

The choke coils D and the condenser C prevent the intrusion of the high frequency currents into F_1. It might be said here that even if the currents were to leak into the ordinary equipment, the subscriber would not be disturbed, as the high-speed currents are not audible in the ordinary receiver. On the other hand the high-frequency currents would be affected by the microphone in F_1. The result would be that the conversation starting out from F_1 could be heard in the high frequency receivers, which is undesirable. As a matter of fact, in the early stages of the tests, before the choke coils and condensers were used, this was actually the case.

F_2 is the connection of the subscriber, whose conversation is transmitted by the high-speed a. c. equipment. The currents going out from F_2 act through the repeater U upon the parallel or series-connected primary coils of two repeaters U_1 and U_2. Under these conditions U_2 acts merely as a sort of loading resistance. The telephone current in U_1 acts under certain conditions by way of the amplifier V_1 upon the circuit GK of the high frequency tube sender. By doing

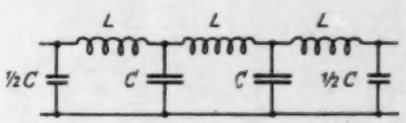


Fig. 4. Choke Coil for Multiplex System.

this the strength of the oscillations produced in the sending apparatus is changed in such a manner as to keep in tune with those of the telephone currents. The alternating currents influenced in this way are then sent out of the tuned secondary circuit SK of the sending apparatus into the telephone line. In order to prevent the incoming telephone currents from reacting on the alternating current amplifier, which might lead to disturbing sounds in the low frequency amplifier or trouble with the repeater, it might be advisable to use a bridge or differential system.

Between sending apparatus and the telephone line a choke coil is used as shown in Fig. 4. This type of chain or coil-like conductor has been arranged to have the frequency equal to the equation:

$$f_o = \frac{1}{\pi\sqrt{L\,C}}$$

increased to about 1.5 times the operating frequency of the particular sending apparatus used. Under such conditions all the overtones of the sender lie above its frequency and are choked off by the choke coils, while the fundamental oscillations are transmitted without any further damping effect. We might say in other words that the choke coil clears the oscillation curve of its overtones. This is very essential for the prevention of interferences is one of the over frequencies of a sender is in harmony with the fundamental frequency of another sender.

The high-frequency currents coming in from the far end of the line react upon the primary circuit PK of the tuned receiver. From the secondary circuit SK they reach a different kind of choke coil, which allows only currents between a certain frequency limit to pass through, but

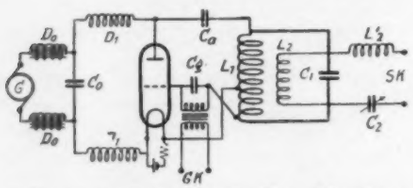


Fig. 5. Cathode Tube Sending Apparatus.

chokes off any other currents. It acts as a sort of selecting or retarding coil and so to speak sifts out the useful from the unnecessary currents. This selective choke coil then passes the current on to the circuit GK of the audion. In the audion the high-frequency currents are changed back into ordinary telephone currents. These telephone currents after being amplified at V_2 reach the subscriber's apparatus F_2 after passing over the repeaters U_1 and U_2. A portion of the incoming telephone current closes by way of U_1 and is lost for the subscriber's telephone set; by making use of properly dimensioned repeaters this loss can be reduced to a minimum.

V_1 and V_2 are single-step cathode tube amplifiers, and their degree of amplification can be reduced by the parallel resistances W_1 and W_2.

Fig. 5 shows the arrangement for the sending apparatus. The current source G is a small direct current generator for 600 volts. The choke coils D_0 and the condenser C_0 are used to eliminate the collector overtones. The choke coils D_1 keep the high-frequency currents away from the feed-current circuit. L_1C_1 is the principal oscillation circuit. This is generated by the tube, which is connected into the circuit with L_1. The telephone currents are brought to the apparatus at GK and cause certain oscillations at this point. These oscillations cause similar changes in the current strength of the oscillation circuit. The rapid alternating currents are transmitted by the coil L_2 to the secondary circuit which is connected with the line at SK. The condenser C_2 is used for tuning. The wiring diagram of the tuned coupled receiver is shown in Fig. 6.

Fig. 7 shows the customary audion wiring diagram. The high speed alternating currents arriving at GK react by way of the condenser C upon the grid of the audion tube and give to it a charge whose strength varies in harmony with the amplitude of the high frequency currents. The oscillations of the grid charge cause similar oscillations of the current strength in the anode circuit, which correspond exactly to the telephone currents going out from the subscriber at the far end of the wire. The audion therefore acts like a frequency charger. It takes up the high-frequency currents sent out by the distant sender and gives back ordinary telephone currents. These latter currents are taken up by the repeater which is connected parallel to the anode condenser K and passed on in a strengthened condition to the subscriber by way of the circuit AK.

In Fig. 8 we have a closer view of the sifting coil used between the receiver and the audion. As mentioned previously this so-called sifting coil has the property to pass currents lying within a certain frequency limit, but shutting out all other currents. In a way, it sifts the useful from the troublesome currents, hence its name of sifting coil. The limits of frequency are expressed by the equations:

$$f_1 = \frac{1}{\pi\sqrt{LK}}$$

and

$$f_2 = \frac{1}{\pi\sqrt{LK_1}}$$

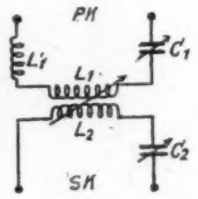


Fig. 6....Tuned Coupled Receiver.

in which K_1 expresses the combination capacity:

$$K_1 = \frac{K \,.\, \frac{1}{4}C}{K + \frac{1}{4}C}$$

In practice C is used at least ten times as great as K. Under these conditions f_1 and f_2 lie close together; and the chain of coils acts like a very close frequency sifting coil set.

The use of such chains of coils was necessary to prevent the action of currents of other frequencies upon the audion aside from the legitimate currents of proper frequency. Unless these coils are used, different disturbing overtones result in the anode circuit due to the varying frequencies. Some of these tones lie within the audible limit and prevent clear conversation, being heard as a whistling noise. This sifting-coil equipment is very necessary, as the selective power of the tuned receiver is not great enough to eliminate all disturbing frequencies from interfering with clearness of conversation. Experience has shown that these coils are of such excellent effect that they may even be used to replace tuned receivers. When using long wave lengths it is even advisable to do without the tuned receiver altogether for reasons which are too theoretical to be discussed in a brief discussion of this type.

During the tests it was noted at various times that the singing spark system used by the Telefunken Company in its wireless station at Nauen (one of the most powerful stations in Germany) interfered with telephone conversation, if the receiving wave used by the multiplex system was anywhere near the frequency of the Nauen

wave. As the electromagnetic waves arising from such sources cause an appreciable electric field only between the telephone line and the earth, but not between the wires of the telephone line, such disturbances can be removed by arranging the connection at the terminal ends symmetrically with the ground, or else by using a symmetric grounding somewhere on the line, as by the use of coils or condensers. Any influence of the high-speed alternating currents upon the normal telephone instruments and the exchange equipment was not noticed anywhere during the tests. Nor were there any disturbances in the two alternating-current connections. A very agreeable and advantageous property of alternating-current multiplex-telephone systems is the gradual disappearance of noises within the apparatus or the telephone lines themselves. These are due to interferences by currents of relatively low frequency, which therefore have no effect on the high-frequency receivers. The alternating-current conversation can be carried on without any interference from other sources within the telephone system. As a matter of fact, good conversation results were obtained with the alternating-current system even when the ordinary telephone system ceased to give good results.

The high-speed alternating currents are transmitted to a much higher degree than ordinary telephone currents by induction to neighboring lines. The ordinary telephone and telegraph service is not influenced by this effect, as alternating currents are not audible in the ordinary apparatus of that type. The question of induction takes on very serious proportions, however, when it is a question of using alternating-current operation on several

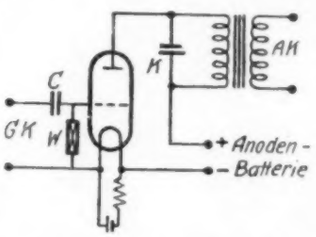


Fig. 7. Diagram of the Audion Cathode Tube.

lines of the same system. It is then necessary to transpose wires and use other means to combat the induction effect of the alternating-current system. Whether these means will be sufficient is still a matter of future tests.

Attempts to use high-frequency currents for telegraphy were also made, using the apparatus developed by Fassbender and Habann. They used frequencies between 230,000 and 500,000 per second, which corresponds to wave lengths between 1300 and 600 meters. Fig. 9 gives the wiring diagram for high-frequency telegraph work.

The telegraphic key *T* lies in the circuit in which the vacuum tube is connected. The receiver to receive the Morse or other signals is connected at *F*. The characteristic of this method is, that the current used for transmitting messages is in the shape of a closed circuit, giving operation by this means. This has been made possible by using the sender at the same time as receiver for the messages sent from the other end of the line. The oscillation frequencies of the two senders are so close together, that the oscillating tone is received. This is audible in the receivers of the two stations at both terminals. When receiving messages the receiving station must press down the sender key constantly, as long as the message is delivered. The operator sending out the

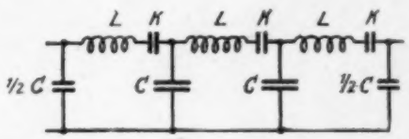


Fig. 8. Sifting Coils for Various Frequency Limits.

messages hears his own signals. If the receiving operator wishes to interrupt, he releases his key, whereupon the signals also disappear at the station from which the message is sent. This latter now must press down his key in order to be able to hear the other operator. Intercourse between stations is therefore very simple.

By using the strengthening effect of the Morse or other code signals, which effect is always the accompanying phenomenon with interference operation, a much greater distance can be reached in telegraphic communication, than when using the telephone. With the apparatus used in the tests which had an oscillation effect of about 0.05 watt, an overhead line of over 120 miles was bridged without trouble. The distance can even be increased by using vacuum tubes of larger capacity and using current with longer wave lengths. Simultaneous operation of several telegraphic stations over the same line can be accomplished similar to the multiplex telephoning, discussed before.

The field of usefulness for multiplex telegraphing and telephoning has grown tremendously since the closing of the war. In all countries there is a tremendous lack of telephone and telegraph equipment of all kinds. On the other hand the demand for better service is growing out of all proportions. France of course is able to meet this demand to a limited extent through the fortunate purchase of tel-

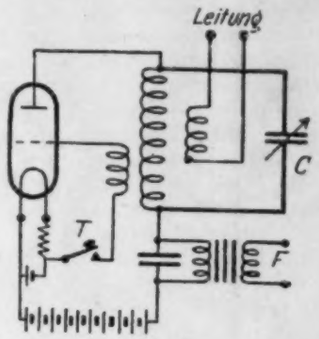


Fig. 9. Diagram for High Frequency Telegraphy.

ephone and telegraph material from our American army authorities. But the other countries and particularly Germany are in no such position. These countries have neither credit nor money at the present time, but still there is the need for telephone service. Since added equipment cannot be obtained, it is necessary to improve the equipment on hand so that it will give more extensive service. As conversations cannot be limited in time as are telegraphic messages, there remains only one remedy and that is to send several messages at the same time over the wires.

The tests made were successful for the line Hanover to Berlin, using three simultaneous messages over one wire. The means on hand allow an extension of that number to five messages. The distances to be bridged depend on the efficiency of the sending apparatus, the sensitiveness of the receivers and the damping effect on the line. It is impossible to tell as yet whether it will be feasible to increase the capacity of the sending apparatus. The present equipment will probably be sufficient to bridge a distance of 180 or 200 miles. As to the damping effect, this increases, the higher the oscillation frequency of the current used. It increases very rapidly if the frequency passes beyond 75,000 periods per second. In other words, it is high, if the wave length remains below 4,000 meters. Consequently it is advisable to use currents with wave lengths below 4,000 meters for multiplex operations. The shorter wave lengths can be used to good advantage for telegraphic communication. In the

latter operation it might be possible to go down to 4,000 periods per second, which would correspond to wave lengths of 75 km. At this frequency the damping effect of a 3-mm. line is hardly greater than that for ordinary telephone currents.

A frequency of 4,000 periods per second of course makes a disturbing noise in the receiver of the subscriber and the apparatus must be freed of this whistling noise, which is done by a system of choke coils made up of Pupin coils and condensers. If the frequency of this choke coil is used about equal to the frequency of the usual Pupin lines, it will be possible to guarantee good transmission of speech. All in all there is no reason why multiplex telephony and telegraphy should not become a commercial success and increase the capacity of the present day telephone equipment many times.—*Telegraphen u. Fernsprech Technik.*

Wages of Operators in Oklahoma

The average wage of telephone operators in Oklahoma has increased from $26 per month in 1908 to $57.10 in December, 1919, according to the testimony of R. I. Caughey, general traffic superintendent of the Southwestern Bell Telephone Company, before the corporation commission. The company was showing its increased operating expenses at the hearing of complaints of poor service.

Telephone operators do not stay with their jobs, Caughey said. In 1918 the loss of workers was 12.3 per cent a month. He said that in the year the company lost one and one-half times the number employed at one time. This, he said, was one reason for poor service.

The cost of giving service per telephone customer increased from 21.1 cents per month in 1912 to 69.1 cents in December, 1919, he declared. The last year showed the fastest increase in price. It cost 22 cents more to serve one telephone in December, 1919, than in January.

Work accomplished by the operators was lessened in the period covered by the investigation, he said. In 1913 each operator completed 120 calls per hour, while in 1919 this had been reduced to 114. In December, 1919, the average was down to 106 calls.

Caughey stated the average operating payroll for a month had increased from $25,000 in 1912 to $167,973 in January, 1920. Much of the increase was accounted for by larger number of telephone users.

Wisconsin Men Talk Measured Service

Measured service as the only fair basis for telephone rates was indorsed by many of the speakers at the convention of the Wisconsin State Telephone Association, February 18 and 19.

The round table discussion was led by S. L. Odegard, consulting statistician, and he gave figures showing the inequalities arising from the unlimited service rates.

The forenoon session Wednesday was taken up with a discussion of accounting for Class C and D companies, which was led by Guy T. Ellis, formerly with the state railroad commission, and Joseph M. Bailey, expert accountant of the Wisconsin State Telephone Association.

Wednesday afternoon George P. Hambrecht, chairman of the state industrial commission, addressed the convention on the administration of the minimum wage law.

The minimum wage law has added an average of 75 per cent to the cost of operating smaller telephone companies, according to Secretary John A. Pratt, of the association.

Walter Gallon, of Antigo, was elected president of the association at the closing session Thursday. Other officers named for the ensuing year were: Vice-president, Arthur Taylor, Rhinelander; secretary, John A. Pratt, Menomonee Falls; treasurer, W. F. Goodrich, La Crosse; board of directors, W. F. Goodrich, La Crosse; John Gallon, Antigo, and John A. Pratt, Menomonee Falls.

Automobile Service Helps Big Drive

"Speedy, accurate telephone service did more to help us put over our membership drive than any other one asset," R. B. Dunn, vice-president of the Lima, Ohio, Chamber of Commerce, said.

The praise refers to the immediate response the telephone exchange gave to the chamber's request for additional telephone service when the drive started.

In one day officials of the local telephone company had installed, free of charge, twenty telephones at the Chamber of Commerce auditorium, and from the start of the telephoning to the last minute committeemen were given the best of service by operators.

During the first day of the drive, those at the head of the campaign say, over 3,000 calls were taken care of in double quick time by the telephone girls and but few seconds were lost by committeemen in waiting for central to make the connections.

While it is not generally known that Lima is the Mecca of all telephone system investigators this fact is nevertheless true. The reason is because the Lima exchange is the largest automanual telephone plant now working in the world and has been pronounced by experts to be the development of the last thing in telephones. More perfect service could not be obtained, engineers say.

Plan Telephone Mile Posts for Ohio Highways

The proposal that public telephone pay stations be installed along Ohio's highways has been made at Columbus.

The suggestion was made by City Councilman Milton W. Westlake.

The plan is designed to aid tourists and other persons who are in need of aid.

Westlake will urge the telephone companies to co-operate in putting into operation the proposal that a telephone be installed at each mile-post. Then, in the event of a breakdown, a blowout, or other troubles, the traveler would be not more than a half-mile from a telephone.

A small fee placed in the box would bring about a connection with the nearest telephone exchange. With a list of telephone numbers available inside the booth, prompt communication could be had with garages, service stations, physicians, city officials or other persons desired by the traveler.

Commercial Radio New York to Chicago

Wireless telephone service for commercial purposes will be established between Chicago and New York, it was announced, following a successful conversation in which Robert F. Gowen, in New York, talked for 30 minutes with R. H. G. Mathews in Chicago.

A wireless station also will be established at Dallas, Texas, it was announced, and test stations will be set up at points in Kansas and North Dakota.

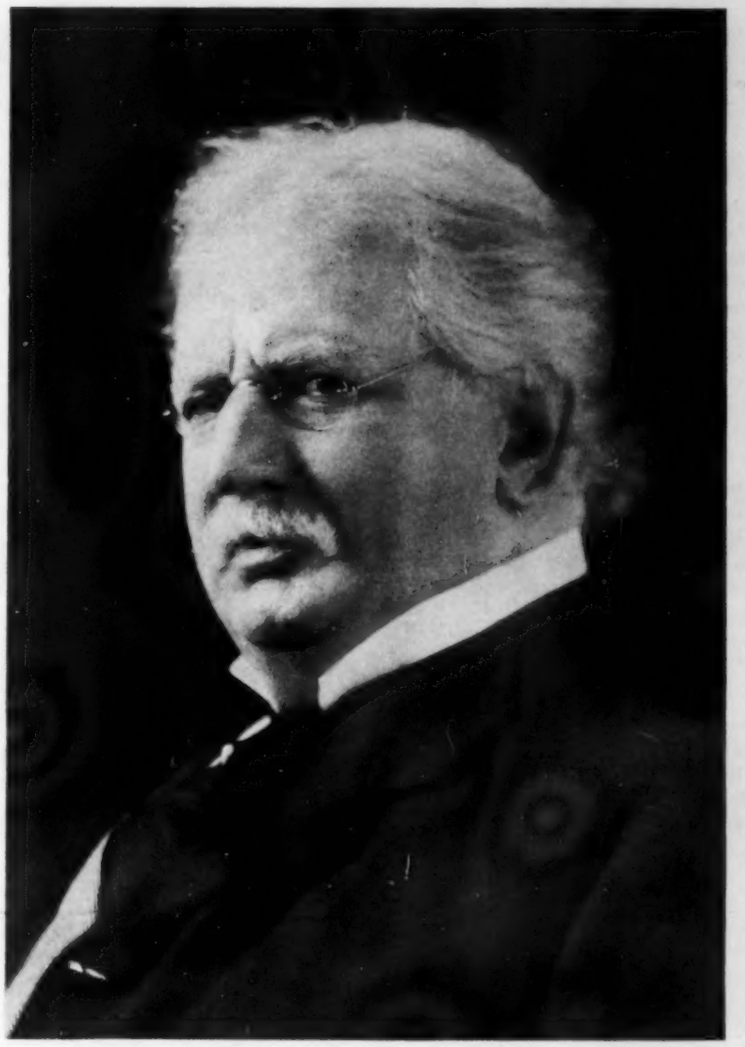
Theodore N. Vail is Dead

World's Most Prominent Telephone Figure Passes Away in a Baltimore Hospital

THEODORE N. VAIL, chairman of the board of directors of the American Telephone and Telegraph Company, died early April 16 at Johns Hopkins Hospital, Baltimore. Mr. Vail was seventy-five years old.

A complication of cardiac and kidney troubles caused Mr. Vail's death. He was taken to Baltimore from Jekyll Island, Georgia, the previous Sunday in his private car. His death was not unexpected to the hospital physicians.

Theodore Newton Vail was the head of the largest telephone system in the world. He was not only its nominal head but also was from the first the genius that promoted the popular use of the telephone, the first man to establish long distance communication by telephone, and when past seventy he was still the head of a system that numbered 9,000,000 telephone subscribers and represented an investment of $1,500,000,000.



THEODORE NEWTON VAIL, 1845-1920.

Mr. Vail was thirty-one years old when Alexander Graham Bell invented the telephone, and he was filling the responsible post of general superintendent of the railway mail service. Still earlier, however, he had been a telegraph operator and interested in the possibilities of electrical communication he had visions that Bell's "toy" would some day be a great factor in American life. Bell and his associates had equal faith in Mr. Vail's organizing genius, and he was easily induced to resign his government post to become the general manager, in 1878, of the first American Bell Telephone Company.

The first line from Boston to Providence was ridiculed as "Vail's side show," but some who indulged in the ridicule lived to see Mr. Vail telephone, not only from Boston to Providence, but also from New York to San Francisco, in 1913, thirty-five years later. Further, in October in that year, they found that it was possible to send the human voice more than half way around the world, as was done by wireless telephone from the government station at Arlington, Va., the words being recorded simultaneously at Honolulu and the Eiffel tower in Paris.

Mr. Vail was a man of remarkable physique. He was 6 feet 2 inches tall, and weighed about 280 lbs.

He was born in Carroll county, Ohio, July 16, 1845, of Quaker ancestry. His father, Davis Vail, removed from Ohio to Morristown, N. J., when the son was four years old, and became associated with a brother, Stephen Vail, who had founded the Speedwell iron works, near Morristown, where they built much of the machinery for the first trans-Atlantic steamship. Alfred Vail, another brother, was one of those associated with Samuel Morse in the invention and promotion of the telegraph. Theodore Vail was educated at the old academy at Morristown, and for a time studied medicine, but becoming interested in the telegraph, he learned to operate the key and went west in 1868 as an operator for the Union Pacific railroad at Pine Bluffs, Wyo.

Through the friendship of General Grenville M. Dodge, chief engineer of the Union Pacific, Vail, in the next year, was appointed a clerk in the railway mail service, and here his ability to systematize and organize was soon felt. At that time the railway mail service was in an undeveloped stage, and Vail prepared special studies on the question of distribution and dispatching of the mail, which brought him quick recognition from the authorities at Washington. It was just after he had been promoted to the general superintendency.

In 1885 he resigned from the original company and became the first president of the newly formed American Telephone and Telegraph Company, which at first made a specialty

of only long-distance communication, but which, in 1900, acquired the property of the American Bell Telephone Company and also negotiated combinations with the principal competing telephone companies throughout the country.

In the meantime, in 1890, Mr. Vail retired from the telephone business. He bought a large farm at Lyndonville, Vt., and interested himself in agriculture. In 1893 he made a trip to South America. From the Argentine republic he obtained a concession near Cordoba, built an electric power station, bought a horse-car line in Buenos Aires, converted it into a trolley line, formed a company and equipped it with the best cars from the United States, bought out all competing lines and gave the city a complete modern service. The company was composed largely of British capitalists, and for some time Mr. Vail had his headquarters in London. When he retired from these activities in 1904, he returned to Vermont, but three years later he was again called on to enter the telephone field as president of the American Telephone and Telegraph Company.

Mr. Vail retired as president of the American Telephone and Telegraph Company last June and became chairman.

One of the most ambitious projects which he then planned was a merger of the Western Union Telegraph Company with the telephone company, and in 1910 when the telephone interests succeeded in controlling the Western Union, Mr. Vail became president of both. He resigned as president of the Western Union, however, when, April 15, 1914, the telephone company disposed of its interests in the Western Union because of threatened action by the government against the combination of these competing utilities.

Mr. Vail played as hard as he worked. He was fond of good music, books and pictures, and the outdoor life. He had one of the finest libraries in Vermont. The house on his 3,500-acre farm at Lyndonville, although beautiful, was a home rather than a palace. In it he had built a $40,000 pipe organ and once every year he made the practice of bringing up from New York some of the finest musicians to give a concert to which he invited the country people for miles around. He also established a farm school.

Service on approximately 12,000,000 telephones was discontinued for one minute April 18 at 10 a. m. as a mark of respect to Mr. Vail. The rule was observed in seventy-five thousand telephone exchanges in all parts of the United States.

New Wireless and Cables From England to Egypt

Through its London information service the Bankers Trust Company is advised that the British Post Office is hurrying the construction of two new high-power wireless stations to supplement cable service between England and Egypt. Cable companies have also laid new lines between England and Gibraltar and between Malta and Alexandria. Another new line between Aden and Bombay is to be laid this spring.

To enable English business firms to expedite their more pressing commercial messages the British Post Office has temporarily arranged for an "urgent" service at triple rates to and from all places served by an association of cable companies in the Near East, India, the Far East, South Africa and Australia. Cable congestion in these sections was recently made the subject of inquiry by the Federation of British Industries. In explanation, the Post Office stated that cable routes to India and the Far East via Germany and Russia are still out of use, and that the number of words cabled in commercial service has greatly increased.

In 1913 the number of words dealt with by a leading company was 64,000,000 while in 1918 the number was 180,000,000.

Chicago System Has Rapid Growth

An increase from one telephone for every 115 inhabitants in Chicago in 1895 to one for every five persons in 1919 is the record of the telephone growth in that city.

There were 600,500 residence premises in Chicago last year, of which 50 per cent were subscribers to telephone service. The "loop" district which contains 20,000 business premises, showed that less than 1 per cent of the concerns were without telephones, according to the company.

Statistics for each five years since 1895 show: That in 1900 there was one telephone for every sixty-one inhabitants; in 1905, one telephone for every seventeen persons; 1910, one telephone for every nine persons, 1915, one telephone for every seven persons, and one telephone for every five persons in 1919.

In striking contrast to this increase the government operated telephone system in France, between 1910 and 1919, showed an increase in telephones of but 34-100 of 1 per cent a 100 inhabitants; those of Switzerland, 61-100 of 1 per cent; of Germany, 75-100 of 1 per cent. The increase in Great Britain was nineteen a 1,000 inhabitants, service being so restricted that it is necessary to pay a premium of $200 to $500 in order to obtain a contract.

Tampico, Mexico, to Have American System

Tampico is to have a telephone service operated by an American corporation. A combination of automatic and central energy system will be installed. A central exchange will be erected and telephone operators employed. The service will be modern in every respect and as good as the best in the States.

Negotiations already have been started to get the necessary permit from the local municipal authorities, to be ratified later by the governor.

R. Estrado Berg and Gustavo L. Trevino were in Tampico making arrangements for securing a concession to be good in May and in looking over locations for a central exchange.

Mr. Berg is the superintendent of the Mexican Telephone and Telegraph Company. Mr. Trevino is the manager of the company's exchange in Monterey.

The company operates plants in Monterey, Yucatan Jalisco, Queretaro, San Luis Potosi, Coahuila, Nuevo Leon and Guarajuato.

This service leads to the immense possibilities of Tampico having eventually a through long-distance connection not only in Mexico, but also with the gigantic Bell system, the American Telephone and Telegraph Company and other affiliated companies in the United States.

A sound proof telephone booth is a rarity, but it has been discovered that any booth can be made absolutely soundproof if it is lined with tin. The new idea is applicable in other places where it is desirable to exclude needless sounds, says the Golden Age.

Chicagoan Exposes Municipal Methods

Chief of Telephone Bureau, Resigning, Tells Inside Story of Political Machinations

THAT municipal control of public utilities would be a calamity has long been the editorial attitude of this publication. Whatever the faults of state regulation, it is at least sincere in its respect for the findings of its engineers, and its general procedure is wholesome. The impossiblity of municipal control without municipal politics becomes evident on every occasion of dispute between a city and its utilities, and the insincerity and questionable propriety of municipal political motives are only too familiar to sophisticated thinkers.

For a number of years the city of Chicago has maintained a quasi-public service commission of its own, under the name of the Department of Public Service. Without any special legal power, this organization was intended to care for the relations between the citizens of Chicago and the public utilities of that city, and has actually done excellent work in that field.

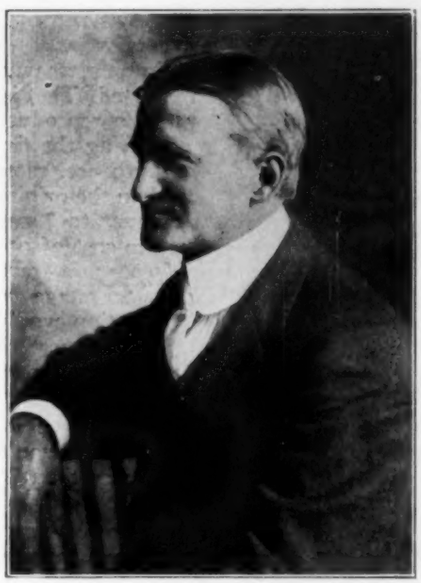
Now G. W. Cummings, chief of the telephone bureau of the department, after a series of political experiences most unpleasant to any reputable engineer, has resigned. His letter of resignation reveals so much of the municipal handling of public utility situations, and bears so closely upon the topic of recent editorials in TELEPHONE ENGINEER, that we consider it well worth presenting to utility managers in other cities without further comment.

"April 9, 1920.

"To Mr. Wm. H. Reid, Commissioner of Public Service, Chicago, Ill.

"Dear Sir:—I entered the city service as chief of the Telephone Bureau on August 21, 1914. I was certified to the position by the Civil Service Commission as the result of a competitive examination. I accepted it because I realized its immense possibilities for benefit or harm to the people, and as a citizen of Chicago I did not dare take the responsibility of refusing it and thereby pehaps exposing the people to what I felt to be the serious danger of the appointment of a man who would use the position for his own aggrandizement at the expense of the public welfare. That same reason has kept me in the position till now, at a considerable sacrifice of opportunity, money, and pride. While political interference and lack of adequate appropriations have to a large extent prevented the broad, constructive accomplishment for which I had hoped, I have served the public to the best of my ability, with resultant benefits which, in my judgment have been worth many times their cost.

"The most important task of the Bureau has been in connection with the revision of the rates of the Chicago Telephone Company. Under the 1907 ordinance this revision was due May 26, 1918, and the Bureau



G. W. Cummings.

was actively at work on the problem for over a year before that date. We did not receive definite instructions from the City Council, however, until August 21, 1918. As we had already collected practically all the necessary data, the work of analysis and compilation required only about a month, and resulted in one of the most thorough and comprehensive reports ever prepared for a regulatory body. It was prepared at an expense in addition to the regular appropriation of the Bureau of less than $100.00, a considerable portion of which was paid out of my own pocket in order to save time. For political reasons, my report was suppressed, and the reports of my conferres, Mr. Westphaln of the comptroller's office and Professor Bemis, a consulting engineer, were hushed up and sidetracked after reaching the sub-committee. This suppression was done in the face of constantly increasing costs and a progressive and critical impairment of the service, and its apparent purpose was to continue special privileges to a few large users of telephone service at the expense of the great body of telephone subscribers. It resulted in the postponement of rate revision to a much less favorable time, and ultimately in a loss of jurisdiction by the city and the establishment of the present higher rate schedule by the Postmaster General and the State Commission.

"It is possible that increasing costs would have necessitated rate increases in any event, but the outstanding fact is that after forcing the other utilities over to the State Commission, the city finally threw away all vestiges of the measure of home rule which had been so carefully and laboriously acquired in past years, by deliberately kicking the telephone company out of the City Hall in order that, instead of attempting to solve a purely business problem in a business way, the corporation counsel might be in a position to "bunk" the people by putting up an apparently earnest fight for their rights before the State Commission. The only possible result of this has been, in the telephone case as in the gas and traction cases, to boost the political capital of the administration at the expense of both the people and the utility companies.

"The city having adopted this policy, I loyally subordinated my judgment to that of my official superiors, and bent every effort to co-operation with the corporation counsel and to furnishing him all available data for use in his fight before the Commission. My reward for this self-sacrifice was a spectacular attack on my good faith, and eventually my elimination from the rate case and relegation to the position of a seeker for special favors in the way of telephone service for political friends of the administration. With no further opportunity for usefulness to the people,

no self-respecting man could remain in so anomalous a position, and I therefore respectfully tender my resignation, to take effect at your earliest convenience. I have no plans for the future, but shall at least be free to attempt a man's work in the world.—(Signed) G. W. CUMMINGS,
Telephone Supervisor,
Department of Public Service.

"Reproduction New" Means Higher Rates

Possibility of rate increases of nearly 100 per cent for all public utility operators is seen in the decision of the United States Supreme Court upholding the "reproduction new" as the valuation basis for fixing railroad rates.

The decision was made in the case of the Kansas City Southern Railroad against the Interstate Commerce Commission. According to press dispatches from Washington, the Supreme Court held the present value of physical property of the railroad should be accepted as the basis for determining rates.

In most cases physical property of railroads, street car, telephone, electric light and power and gas companies of the country would cost nearly double their original values if reproduced today.

Property value is the largest item considered in rate fixing. Other items are operating cost and percentage of profit. From the valuation must be deducted the amount of depreciation.

In fixing the new schedule of rates for Bell telephone companies operating in Indiana the public service commission recently refused to accept the "reproduction new" basis offered by the company, but based the new rates on the reproduction values of companies' various physical properties throughout a period of five years. Many other rate cases have been decided by the commission on the same basis.

Conditions similar to those created in Indiana by the basis established by the Supreme Court exist in various other states.

Little doubt is entertained by rate experts that the railroad decision will be so far-reaching as to affect every form of industry over which a government institution possesses rate-making authority.

Value of rolling stock of the Kansas City Southern Railroad was not offered for consideration by the Supreme Court, according to dispatches, but the court found for the appellant on its present-day cost of right-of-way and terminals contention.

The Indiana commission has followed the rule established in several other states of basing valuation estimates on an average of production costs throughout a period of five years. In the case of the Bell telephone companies the commission took an average of production costs in the years from 1913 to 1918. Present-day material prices were held by the commission to be abnormal, and, therefore, not suitable to the formation of a sound rate-fixing estimate.

It is difficult to foresee the results of the establishment of the new basis of valuations. As far as rates are concerned it is quite clear that the "reproduction new" values of nearly all utilities would make rates nearly double present rates if a profit margin of 7 per cent is maintained.

If a telephone company's property cost $100,000 five years ago, it is worth today $200,000 in a fair round figures estimate, it is asserted. That is, it would cost that much to reproduce it today. Without confusing the figures with depreciation expense, rates for that company, based on the original valuation, would amount to 7 per cent of $100,000, plus the cost of operation. That would mean upward of $7,000. The same percentage of profit on a $200,000 valuation would mean about $14,000, plus the cost of operation, which would be the same under either valuation.

Thus it is seen that the new valuation as against the old system would mean rate increases of more than 95 per cent.

Even in cases where the five-year-period valuation basis is used, the new valuation would mean rate increases of more than 75 per cent, experts say.

Telephone Attachment Records Voice

An invention which may, among many other possible uses, be employed as a complete insurance against error of transcription of court testimony by stenographers, has been achieved by Major Lionel Guest and Capt. H. O. Merriman, a Canadian electrical engineer. It consists of apparatus for recording and reproducing sounds carried electrically over a wire.

In a demonstration of the device a message was dictated into a telephone placed in the drawing room of Major Guest's house in London.

At the other end of the wire in another room was a recorder which automatically inscribed the message on a gramophone record. In a few seconds the record was placed in a gramophone and the messages was repeated with great clarity.

Major Guest claims that the best results hitherto obtained in recording the voice or music over the telephone have been unsuccessful through being "blurred" or metallic in tone. "The development," he said, "has immense possibilities. I think in the near future it will be possible for a receiver to be placed in a part of the hall where the speaker's voice is hardly audible, say in Manchester, and at the other end of the wire in London the message will be recorded verbatim by the telephone recorder, for instant reproduction through ear pieces to the newspaper offices.

"If the receiving operator misses a word he presses a button and the line or any number of lines are repeated as often as he likes.

Michigan Report Shows Need of Relief

The Michigan State Telephone Company must have higher rates for its service, if lines are to be expanded and maintenance kept up to standard, according to the annual report of President Franz C. Kuhn on the company's finance. Mr. Kuhn recently resigned as justice of the Michigan supreme court to accept the presidency of the company.

The statement shows that the company's income has been totally inadequate to meet expenses of operation, although the rapidly expanding industries of the city and state demand not only that service be maintained up to normal standard but that facilities be expanded. An outstanding fact shown in the statement is that if the company is to meet the situation and provide service necessary to the continued growth in population and industry of Michigan rate relief must be granted.

A. T. & T. Capital Increases to $750,000,000

The American Telephone and Telegraph Company has certified to the secretary of state at Albany, N. Y., that it has increased its capital stock from $500,000,000 to $750,000,000.

Machine Switching in the Bell System

A Semi-Technical Description of the Apparatus and Its Characteristics

By E. P. CROFT

IN an announcement appearing in the monthly publications of the various associated Bell companies, Bancroft Gherardi, vice-president and chief engineer, and Harry P. Charlesworth, equipment and transmission engineer of the American Telephone and Telegraph Company, describe the machine switching exchange system which is to be introduced in the larger centers of the Bell telephone system.

It is the purpose of this article to give a little more intimate picture of this new development. We can do no better than to quote from Messrs. Gherardi and Charlesworth's announcement, the following, regarding the proposition as a whole:

"From the invention of the telephone, the Bell system has continuously developed the telephone art, of which switchboards are but a part. New improvements in telephones, switchboards, lines and cables have followed one another with remarkable rapidity. While each successive type of apparatus to the superficial observer sometimes suggested similarity, nevertheless each step in the evolution marked a decided improvement.

"In general, these improvements have been of such a nature that they have not necessitated a change in the methods used by subscribers in making calls. One of the factors of the machine switching problem which added to its complexity was that from its very nature this system necessitated a change in the manner in which a subscriber made his telephone calls. This phase of the problem had to be most carefully considered, so that the arrangements adopted for all classes of calls would be simple and could be employed by all subscribers without the chance of complications, difficulties or misunderstandings.

"From the time of the earliest switchboards there has been a constant effort to perform various operations automatically so far as consistent with the service requirements, and many new features have been introduced from time to time for reducing the work required on the part of the operator. In line with these developments, telephone engineers early applied themselves to the problem of completing calls entirely without the aid of an operator. Many forms of automatic systems have been developed and tried out from time to time, but none of these satisfactorily fulfilled the complicated service requirements of large cities.

"An indication of the magnitude of this problem may be secured when we consider that in New York City, for example, there are at present a total of nearly one million telephone stations served from about ninety central offices, and the predictions are that within the next twenty years the stations and central offices will have more than doubled. Each subscriber in this great network must be able to reach promptly every other subscriber. Due to the large area involved a great number of calls within the city involve extra charges, which means that they must be specially supervised and ticketed. There are many different classes of service furnished the public, such as measured rate, flat rate, official, coin-box pay station, attended pay station, and other special services, such as information, etc. Not only individual lines, but party lines and private branch exchanges must be cared for. Furthermore, demands for service to the extensive suburban are surrounding this great city, as well as to the vast number of cities, towns and rural communities throughout the entire country require that provision be made for thousands of toll messages daily which must be recorded, supervised and time. It will be clear that the problem of producing machine-switching equipment which will satisfactorily perform a sufficient amount of the labor involved in handling the above service, so as to replace enough operators to warrant its existence, is not one that could be solved except after years of development work. It will also be evident that systems which might operate satisfactorily in cities of small or medi-

Fig. 1.

Arena Dr John, r, 2156 Bathgateav ..... FOR dham 4141
Arena Theatre, 623 8th av ..... BRY ant 5409
Arend Ernest, A, Archt, 105 W 40 ..... BRY ant 3231
Arend F J, 165 Bway ..... COR tland 0940
Arend F J, r, 813 5th av ..... PLA za 4226
Arends Katharine, MD, 178 W 97 ..... RIV rside 0570
Arent E, 156 W 86 ..... SCH uyler 2861
Arendt Edwd & Son, Leaf Tob ..... JOH n 1635
Arendt Ellis, 151 Water ..... 151 Water ..... JOH n 1635
Arednt Simon, r, 29 E 129 ..... HAR lem 4202
Arengee Co, 21 W 4 ..... SPR ing 7224
Arens A, Leaf Tobacco, 182 Water ..... JOH n 4747
Arens Miss Adele, r, 29 W 84 ..... SCH uyler 2493
Arens Burchard, Cafe, 520 8th av ..... GRE eley 5141
Arens Edgmont H, Bookseller, 17W 8 ..... STU yvsnt 0717
Arens F X, r, 119 W 80 ..... SCH uyler 6347
Arens Max, Lawyer, 271 Bway ..... BAR clay 5786
Arensberg A, Drugs, 1002 So blvd ..... INT rvale 2925
Arensberg M, r, 961 St. Nich av ..... AUD bon 1520
Arensberg Walter C, r, 33 W 67 ..... COL mbus 4826

Fig. 2. Typical Examples of New Form of Listing Telephone Numbers.

um size, where service requirements are comparatively simple, would not meet conditions in these large metropolitan areas."

From the foregoing it will be seen that machine switching is not a particularly new thing, and in its present embodiment is the result of a systematic study of conditions of service and the development of a system best adapted to meet these conditions.

In its elements a mechanical switchboard is nothing more nor less than a combination of apparatus in which a mechanically propelled cord associates itself with the terminals of your line when you remove the receiver from the hook, and then under the control of the electrical impulses sent out by your calling dial, automatically associates the other end of this connecting cord with the terminals of the line with which you wish to connect. In other words, substituting a machine for the operator, who now picks up a cord and inserts one plug in the jack of your telephone line, and upon learning the number required plugs the other end of the cord into the jack of the line you are calling.

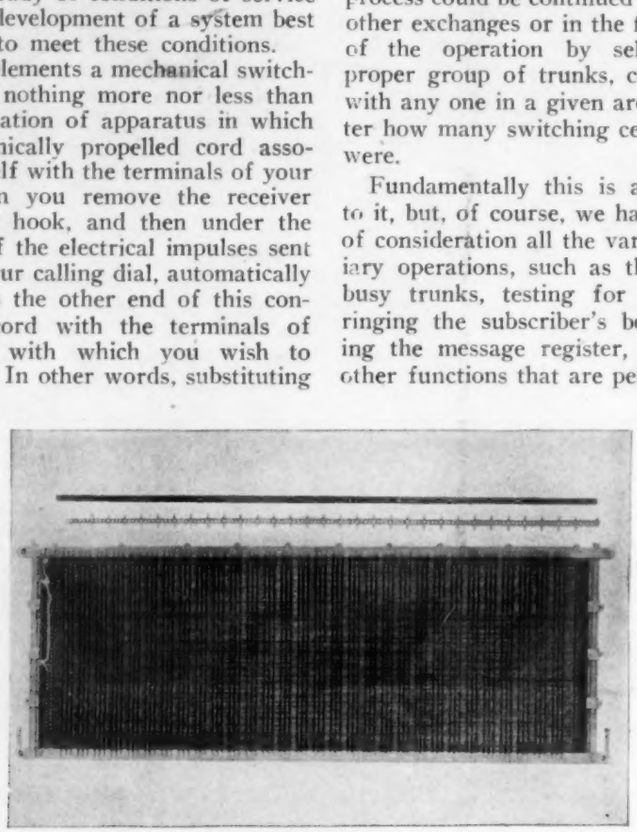


Fig. 3. Multiple Bank, Showing Individual Insulating and Terminal Strips.

The above is a fair picture of what takes place in the small town where there is one exchange. When we come to the larger places, however, where there are a number of central offices, the chances are that the majority of your calls will be for subscribers connected to exchanges other than your own. It then becomes necessary for this mechanical switchboard, and the manual as well, to perform an intermediate operation which consists of selecting a trunk line leading to the exchange in which your wanted subscriber is located. The difference here is that your mechanical operator, instead of connecting you direct with your subscriber, picks out an idle trunk to the exchange wanted, and another mechanical operator at that point picks up your connection and through its mechanical connecting cord associates it with the line you want. It is evident that this same process could be continued on through other exchanges or in the first step of of the operation by selecting the proper group of trunks, connect you with any one in a given area, no matter how many switching centers there were.

Fundamentally this is all there is to it, but, of course, we have left out of consideration all the various auxiliary operations, such as the test for busy trunks, testing for busy line, ringing the subscriber's bell, operating the message register, and many other functions that are performed in the ordinary course of establishing a complete connection. In order, however, to avoid a brainstorm, we must take all these things for granted, as having been accomplished in the mechanical system with substantially the same result as in the old manual system.

The items of new apparatus that go to make up the system will now be briefly described.

SUB-STATION DIAL

This dial, which is illustrated in Figure 1, is located at the subscriber's station. In the case of a desk-stand, it is mounted on the base, and in the case of a wall set, on the face of the set itself. It is so designed that by manipulating a finger wheel electrical impulses are sent out over your line, corresponding with the numerals or letters appearing in the holes. When used in the larger cities, the dial will bear certain letters of the alphabet in addition to the numerals, and in the smaller centers numerals only may be employed. In making a call the subscriber will, of course, refer to the telephone directory, and he will find in the new directory that the central office name is printed somewhat differently from heretofore. Typical examples of the new form of listing telephone numbers are shown in the illustration, Figure 2. These conform to the present manual listings, except that the first three letters of the office name are set out prominently. Simple as this change in the form of listing appears, until it was developed no satisfactory system of designating telephone numbers for machine switching systems for large cities, such as New York, Chicago, Boston and Philadelphia, was known.

One advantage of this plan is that it does not necessitate the abandonment of all of the existing manual designations. For manual operation it leaves them substantially as at present. For machine-switching operation the same form of listing is used in the directory, a clear indication being given as to the portion of the listing which should be dialed in making an automatic call.

Under this plan machine-switching calls are passed to the central office mechanism by dialing the first three letters of the office name and the four numerals followed by the party line designation, if any.

In medium size multi-office cities where six-digit calling is practicable, only the first two letters of the office name will be given prominence in the directory. In very small multi-office cities where only five digits are required, the telephone number may consist of five numerals and no letters may appear on the dial.

The selector mechanism, which is used to perform the various automatic switching functions within the office, consists of a so-called "bank," made up of a large number of horizontal brass strips, insulated from each other and piled up so that there may be as many as 300 in one panel, which will comprise the terminals for 100 lines or trunks. These strips have projecting lugs on each side to provide contact members, over which vertically operated brushes or elevators ride. A close view of one of these panels is shown on Figure 3.

Arranged in front of this panel or as in practice, a group of five panels

serving 500 lines, or trunks, are vertical lift rods having triple contact brushes, which ride over the projecting lugs of the panel. These lift rods can be moved up or down at will and are under definite control by means of the continually moving friction rolls at the base of the frame. Each lift rod has associated with it a system of electromagnets which, when operated to force the flat metallic strip which forms the end of the lift rod against the rolls, will move the rod at slow speed or high speed or will return it to its normal position, depending upon the magnet that is energized. Figure 4* shows a section of a frame with the brushes in various positions. It also shows some of the electromagnetic clutches removed and exposing the friction drive rolls. Figure 5 shows a completely assembled selector frame arranged for 500 lines, or trunks, with 30 elevators or brush rods on each side.

At the top of the frame is a commutator or impulse-making device which has associated with it a brush permanently attached to the lift rod. This is for the purpose of sending out electrical impulses as the brushes pass over the terminals of the bank, and in connection with the "sender," which will be described later, controls the

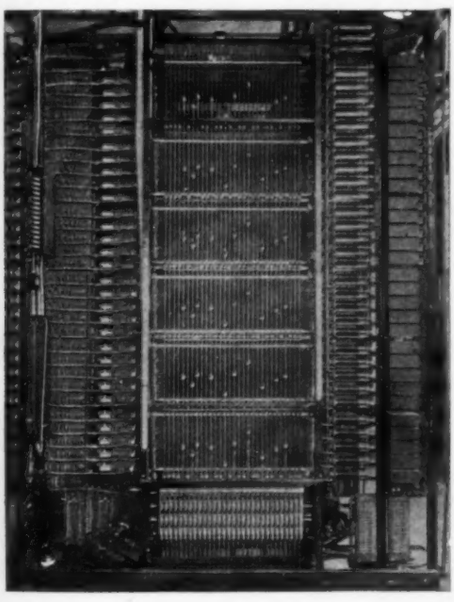


Fig. 5. Selector Frame.

movement of the selecting mechanisms. Figure 6 shows the commutator and its brush more in detail.

At the right-hand side of the selector frame will be noted a row of mechanisms which are known as sequence switches, and one of these is shown in Figure 7. This is a power-driven contact-making device somewhat on the order of an electric-sign flasher, and is used to perform certain circuit-switching functions incidental to the operation of the selecting mechanisms. One of these switches takes the place of a large number of ordinary relays, and performs the work very much more cheaply and accurately. By simply changing the shape of the metal segments on the cams, one of which is shown at the right of Figure 7, any desired combination of opening and closing of circuits may be set up as the shaft revolves.

SENDER

It will be noted that the dial is arranged with ten holes, and a complete revolution of the finger wheel will send out ten impulses, and successive operations of the dial will send out successive groups of impulses ranging from one to ten. In other words, these impulses are sent out on a decimal basis. You will recall that the panels of the selector frames are arranged in banks of 500. These large groups are desirable because it makes possible a more economical use of trunks between offices and also reduces the cost of the apparatus because of the larger number of trunks a single lifting mechanism may serve.

In order, therefore, that the decimal impulses sent out by the calling dial may properly select a terminal in the non-decimal group making up the panel, we employ a so-called "sender," which is a contrivance arranged to receive and store the impulses as they are sent in from the calling device. It then controls the elevators or selectors in their upward motion toward the terminals of the trunk group or line wanted, in such a way as to cause them to arrive at the proper point no matter where the terminals may be located in the selector banks.

When the elevators are started upward, the "senders" permit them to go to the desired point and stop them by removing their driving power. This is accomplished through the commutators located at the top of the selector frames, which, as the elevators move, transmit back to the "sender" the number of impulses which the "sender" has been set to receive, by the manipulation of the calling device at the subscriber's station. This method of operation is known as the "reverse impulse control" and is an outstanding feature of our machine-switching system, and is distinguished from other systems which have been used, wherein the selecting mechanisms are operated directly by impulses of current, the duration, character and

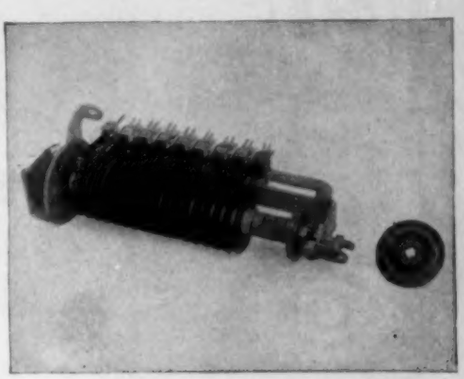


Fig. 7.

speed of which are controlled solely by the calling device at the subscriber's station. The use of the "sender" is also a new feature in the mechanical switching system, and with the "reverse-impulse system of control" possesses many advantages, some of which have been touched upon and others will be described later.

Figure 8 shows a sender frame, which is nothing more than an aggregation of sequence switches, relays and small twenty-two-point selecting switches all wired together in a manner that no human being should be called on to understand.

Figure 9 shows a circuit diagram of one of these senders, of which there are about 200 in an average office, and when we consider that each one of these wires and terminals serves a definite purpose and must be just that way and no other, we may feel there is some justification for characterizing the "sender" as the "brain" of the mechanical system. In fact, that is just exactly what it is. Later on we will learn of a few of the marvelous things it does.

Now that we have a picture of what the apparatus looks like, let us see how it functions in its business of connecting one telephone subscriber with another. Figure 10 shows a schematic drawing of three central offices with the apparatus units so arranged as to show a connection set up from one to another. The terms "line finder," "district," "office" "incoming" and "final" applied to the frames are simply designations of the uses of the selector frames previously described in detail. Mechanically they are similar and serve to associate connecting brushes with any one of a

*See Frontispiece, page 12.

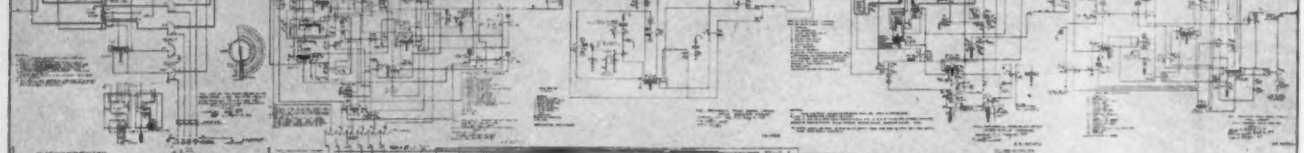


Fig. 9. Schematic Circuit Diagram of a Typical Sender.

group of line or trunk terminals. The subscribers line terminates in a set of multiple bank contacts in the line finder frame, which contacts correspond to the answering jacks in a manual office. When the receiver is lifted from the switchhook preparatory to dialing, the terminals of the line are selected by a brush of one of the vertically moving lift rods in the line finder frame, and connected automatically to an idle "sender" by means of a small selecting mechanism. Upon completion of these operations, which take but a fraction of a second, a tone is sent out to the calling subscriber indicating that the connection is established to the point where he may commence dialing the number. When the subscriber operates his dial, the electrical impulses (on a decimal basis) are transmitted to the "sender," which receives and registers them, and in turn translates them to the proper basis for the control of the apparatus which is not operated on the decimal system, and then controls this selection through the apparatus, as referred to below.

As shown in the diagram the calling subscriber is in the GARfield office. When this subscriber starts to dial, the "sender" automatically causes the particular district selector, which is permanently associated with the line finder originally used, to start and select a trunk leading to the office desired, namely, PENnsylvania. This may be done either directly or through an office selector, in case the number of trunk groups is too large to be placed on the district selector. Assuming that the PENnsylvania office is on an automatic basis, the trunk chosen will terminate at an "incoming selector" frame and the "sender" above referred to will cause the call to be routed through the "incoming sellector" to a "final selector" and thence to the particular line desired. When the connection is thus completed, audible signals will be sent back to the calling subscriber to indicate that the station is being rung or that the line is busy.

If the call had been for another subscriber in the same office, GARfield, instead of in the PENnsylvania office, it will be noted that the call would be routed from the "district selector" to an "incoming selector" in the same office and thence to the particular "final selector" in which the desired subscriber's line is located.

As soon as the subscribers have completed conversation and hung up their receivers, the connection through the automatic machinery is immediately disconnected and the apparatus returns to normal.

Previous mention has been made of the fundamental similarity between the processes in the mechanical and manual systems and to those familiar with the operation of manual systems, the progress of a call as just described, very strikingly brings out this point.

If the call from GARfield had been for a subscriber connected with a manual office North, the "sender" would have so guided the district and office selectors as to have caused them to select a path or trunk leading to the manual office desired, where the trunk would have terminated in a cord before the operator at what is called a "call indicator position." A lamp would have been lighted and the operator upon depressing a key associated with that trunk would have allowed the distant "sender," that is at GARfield office, to cause the numerals of the line desired to be displayed before her on a "call indicator," whereupon she would, by means of a cord, connect the trunk with a multiple jack of the line desired, and ringing would be started automatically. It will be observed, therefore, that so far as the GARfield subscriber is concerned, he is not aware of the fact that in the case of the PENnsylvania office call, his subscriber is in a machine switching office, and in the case of the NORth office, in a manual office.

If a call is originated by a subscriber connected to a manual switchboard for a subscriber connected to a mechanical office, it may be handled in a number of ways, depending upon the type of equipment installed. The simplest plan is to

place a "B" switchboard in each full mechanical office and let all incoming calls from manual offices be ordered up by the "A" operators over a call wire through this "B" operator. The operator at the mechanical office is known as a "cordless B operator" and establishes all connections to the mechanical subscribers in her office through the medium of an adding machine like key set which controls the automatic switches. Other methods of establishing connections from manual to mechanical subscribers are the key-indicator plan and the scheme of equipping each "A" operator in the manual offices with a dial. Both of these plans provide means whereby the "A" operators can complete their own connections in distant full mechanical offices by setting up or dialing the desired numbers.

Figure 11 is a general view of a mechanical switching office, showing the various classes of selector frames arranged in bays.

Figure 12 shows a typical installation of cordless B positions in a machine switching office, which are used to complete the calls originating in a manual office.

Figure 13 shows an operator's position in a manual office arranged for "call indicator" operation, that is, for completing in the manual exchange calls originating in a mechanical office.

Figure 14 shows in detail one of the call indicators where the number is indicated by the illumination of letters and digits, where the number is displayed with letters and digits illuminated by small electric lamps.

From this brief description of the machine switching system, it is evident that the introduction of this form of telephone equipment has involved and will continue to involve a vast amount of work.

This system is the result of the combined efforts extending over a long period of a large technical staff, and although the manufacturing program is already making necessary extensive additions to manufacturing plants, there still remains a tremendous amount of engineering and development work, to adapt the system to the particular service conditions as they are encountered in various localities. At the present time the engineering department at West street, New York, is devoting a very substantial part of its effort to machine switching work. Because of the newness of the system and the comparative inexperience of the manual-switchboard editing personnel, the engineering department at New York is doing all of the equipment engineering in connection with the first offices in any given territory, the plan being that as rapidly as possible this equipment work will be transferred to the switchboard editing engineering group at the Hawthorne works. As a matter of fact, a very heavy schedule on this class of work is now being carried by the latter organization.

To convey an idea of the magnitude of the work involved in getting out the detailed plans for a machine switching central office, we should first start out with the picture that a machine switching office for a given number of lines contains about twice as much apparatus as in a similar-sized manual office. Not only must there be provided machinery for performing the purely mechanical functions that have heretofore been supplied by the operator, but there is an additional element which has been previously touched upon, which serves as a substitute for the intelligence of the operator, namely, the "sender," and while in number of parts and size of equipment, it does not loom very large from a manufacturing standpoint, the intricacy of the circuit arrangement and the precision with which the various elements must function, provides a very complicated engineering problem, which must be worked out in detail to meet the service conditions as they appear in any particular locality.

To give you an idea of what this "sender" really does, it may be of interest to enumerate some of its stunts.

1. It receives a succession of electrical impulses on a decimal basis and translates them to a non-decimal basis corresponding to the particular group of lines and trunks that may be involved in the particular connection.

2. It receives impulses transmitted by the subscriber's dial as rapidly as they can be sent, but it controls selecting mechanisms which build up the connection to the desired party in such a manner that each mechanism is given the exact time required to perform its function without any waste of time.

3. It allows the subscriber in any office to be called by dialing the first two or three letters of the office name, together with the subscriber's number in that office.

4. It translates the office code dialed, so that the trunks to that office can be found by the switching mechanism, in any arbitrary position that the telephone company might find it desirable to place them.

5. The "sender" is capable of distinguishing at what class of office the connection will terminate. That is, if the call is to terminate at a mechanical office, the "sender" will arrange to govern the selection accordingly. If the call is to terminate at a manual office, the "sender" will recognize this and arrange to send out impulses to the call indicator equipment.

6. For the completion of certain calls, traffic conditions require the introduction of tandem points. The "sender" will recognize calls going via tandem points and will arrange to handle these correctly. The tan-

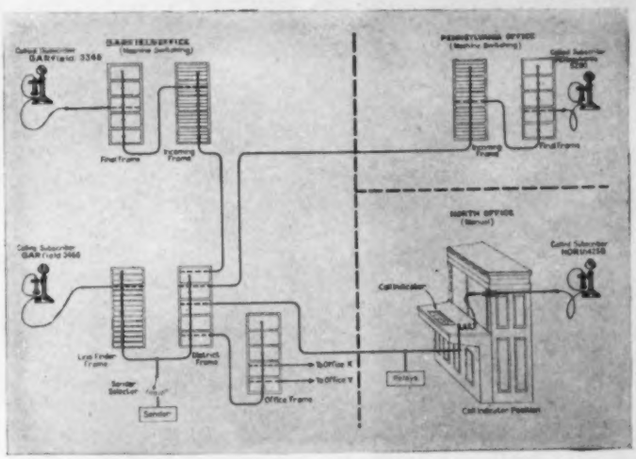


Fig. 10. Diagram Showing Progress of a Call From an Automatic Subscriber to Another Automatic Subscriber or to a Manual Subscriber.

dem point may be a manual one or it may be a mechanical one, and the impulses must be governed accordingly.

7. The "sender" after recognizing the call's terminating office will know the class of trunk that leads to that office and arrange to adjust its electrical resistance so that all operations are made over practically uniform line resistances.

8. The "sender" will also cause the proper combination of transmission apparatus to be introduced into the line. The repeating coil that is employed is different for loaded lines than for non-loaded lines, and is different for heavily loaded than for lightly loaded lines. Similarly for calls to an operator, as for instance the recording operator, the "sender" causes the subscriber's line to be extended to the operator's trunk without the inclusion of any repeating coil.

9. A switch, after selecting a group of trunks may find all of them busy. The "sender" will recognize this and immediately arrange to disconnect the train of switches and cause a busy tone to be given to the subscriber.

10. Certain "senders" are arranged to serve lines supplied with coin boxes.

These "senders" permit the subscriber to dial the number of the desired line before the coin is deposited, but will not allow the connection to be cut through so that conversation can take place until the coin is deposited. If the subscriber does not deposit the coin, after a reasonable time has elapsed, the "sender" will cause a monitoring operator to get in on the connection, and this operator will notify the subscriber of this omission. After the coin has been deposited, the "sender" will allow the called subscriber to be rung and will permit the conversation.

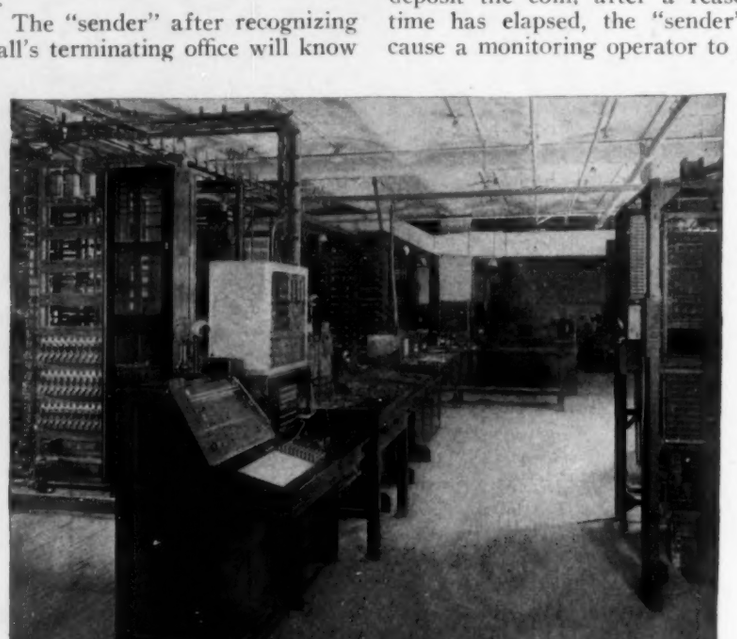


Fig. 15. One of the Machine Switching Laboratories.

In case the called subscriber does not answer, the "sender" will return the coin to the calling party. Similarly, had the called party answered, the "sender" would have caused the coin to be collected.

The "sender," in making a test of the calling line after the subscriber has completed dialing, to insure the deposit of the coin, is capable of recognizing whether a coin has actually been deposited or whether the subscriber is trying to "beat" the instrument, in which case the abnormal condition is recognized by the "sender," and the call will be routed to a monitoring operator who will cause an investigation to be made.

11. In large areas, such as the Metropolitan area, there are points, connection to which requires excess payment. Should a subscriber attempt to dial outside of the free area, his call will automatically be routed to an operator who will ascertain his wishes and make out the proper ticket.

So it will be seen that we are dealing here with inanimate material which at times seems almost to possess human intelligence.

Figure 15 shows a section of the machine-switching laboratory where all the new circuits and apparatus are set up, wired in accordance with the proposed plan, to make sure that their operation is satisfactory before actual manufacture of the equipment is started. Figure 16 shows a corner of the laboratory devoted to the study of the design of machine switching apparatus, and here all new devices are subjected to extensive tests to deter-

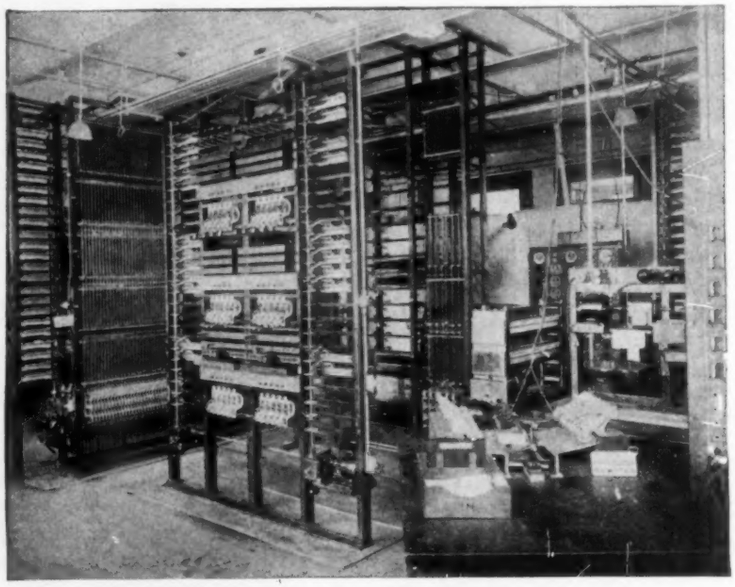


Fig. 16. One of the Machine-Switching Apparatus Laboratories.

mine their operating characteristics, length of life and all other factors that may have a bearing on its successful use in service. At the present time there are employed at West street 350 engineers and draftsmen whose entire time is devoted to the further development of machine switching apparatus and circuits, and the engineering of specific machine switching equipments. In one month alone, something over 50,000 blueprints were made up and issued, and over 3,000 equipment and manufacturing specifications prepared and issued. In one machine switching office the engineering for which has been recently completed, the equipment and circuit drawings covered an area of 5,000 square feet, and that was for only one set of drawings. So much for the preliminary engineering work that is involved in this new project.

After all of this work is completed the manufacturing department is confronted with the problem of translating this information into shop language, making the detailed drawings of the apparatus, designing and constructing tools for its manufacture and a thousand and one other details which must be provided before actual commercial production can commence.

The fact that machine-switching equipments are now being manufactured and installed is an indication of the intensive preparation work that has been going on for the past few years.

Marconi Prophesies Radio Will Replace Wires

Guglielmo Marconi, inventor of the wireless, asserts that within this present year vocal communications transmitted without wires will replace the system of today.

"Remarkable economic advantages will follow, because it will dispense altogether with the cost involved in apparatus and the maintenance of lines, not to speak of the utter elimination of interruptions now so frequent through the effects of bad weather and the occasional isolation of entire regions in consequence of snowfalls.

"It is a curious phenomenon that, while the most progressive peoples of western Europe have not yet contrived to adopt wireless telephony on an essentially commercial basis, China —the most retrograde among nations —is making daily use of the wireless telephone for communications between urban centers and rural districts which have not been linked up with the ordinary telephone system.

"America stands in the forefront of progress, its inventors having shown themselves capable of producing a really practical instrument for transmitting the human voice by means of electrical waves.

"Today we cannot concentrate the expansion of energy within a limited sector of the circle so as to reach the furthest distances, but eventually science will find a way of directing electric energy without wires in an absolutely straight line.

"Once directive control has been established, we shall undoubtedly be able, by means of powerful machines, to gird the whole world with waves of electric energy without wires by the simple pressing of a finger.

"In respect to wireless telegraphy, I have a radio-telegraphic receiver, no bigger than a gramaphone, by means of which—without any other wonted communication with the atmosphere—I am receiving all day long in my study every scrap of wireless news sent to the European press.

"Very shortly, with an instrument of this kind, bankers, politicians and business men in general, will be able from minute to minute to keep themselves in contact with both hemispheres.

"Very soon, too, that miserable ticking machine, whereon all newspaper offices depend, will yield place to this mighty invention—which is apt for news sending, news receiving and simultaneous communication, with any number of receiving stations.

"In this way the journals will be able to wipe out considerable costs, besides saving the great loss of time now necessary for sending separate messages.

"In the matter of popular education it is easy to understand the remarkable influence this invention is destined to exert when all its possible applications are fully developed.

"Before long its development will have reached a stage when, in contact with an automatic apparatus at the four corners of the earth, news will be registered in clear language without the present day necessity of the Morse code expert.

"With the installment of radio-telegraphic receivers throughout the civilized globe, in every public school, university, and library, the prevailing languid interest of the public in international happenings will be immensely stimulated."

Cincinnati Gets Its First Automatic

The first automatic telephone exchange in Greater Cincinnati will be installed by the Citizens' Telephone Company in Newport, Ky., it was announced by B. T. McBurney, assistant general manager. The exchange will be the most modern of its kind in the country, located on the site now occupied by the home of A. L. Andrews, at Sixth street and Park avenue, northeast. "This automatic exchange will demonstrate the progress that has been made in telephony," declared Mr. McBurney. "We have not decided upon the specifications for the exchange, but it will be something of which the people of Newport and Campbell county can well be proud. Our architect, Harry Hake, will start on the plans immediately, and the work will be rushed as rapidly as possible."

Calls within the Newport exchange will be by automatic, but calls going out to or coming in from another city will be taken care of in the usual manner, the connecting work being done by operators.

Republican Convention Will Have Telephones

Delegates at the Republican national convention, opening in Chicago, June 8, will be able to confer with representatives of other states without leaving their seats.

To eliminate a large part of the confusion incident to conferences between delegates on the floor, C. R. Hall, superintendent of the Coliseum, has arranged for the installation of telephones connecting all state, district and territorial delegations.

It is said that this will be the first time that such a system has been installed at any national convention.

There will be 53 telephones in service, reaching the 48 state groups and the representatives of the District of Columbia, Alaska, Hawaii, the Philippines and Porto Rico.

Labor leaders believe that if the Ohio State were operated municipally the Cleveland Telephone Company would be forced at once to reduce charges, and eliminate registered call systems.

Of Interest to the Trade

What the Telephone and Accessory Manufacturers are Doing to Advance the Art

The Vawter Indicating Ohmmeters

The Vawter indicating ohmmeter measures the resistance of an electric circuit, or a portion thereof, with the same facility that a voltmeter measures electric pressure, or an ammeter current.

A small current is required to operate the instrument, and this necessitates a source of emf. but the indications are independent of the variation of this current, or pressure, over a wide range. This feature is accomplished by a rugged and thoroughly practical electromagnetic control. It is impossible to produce a frictionless moving coil system, nor is it necessary in order to meet actual requirements in designing ammeters, voltmeters or ohmmeters. It is impractical to convey current to the moving coil system without either friction, or torsion, or both, nor is this necessary in order to produce a practical electromagnetic control. Two equal opposing electromagnetic torques act upon the moving coils system, when indicating a certain resistance, and the magnetic flux distribution is such that on moving the system away from this position the torque tending to return the system increases, while the restoring electromagnetic torque produces a state of stable equilibrium.

The emf. employed to operate the system, in its relation to the included resistances, flux distribution, number of turns and lever arm of moving coils, must be sufficiently great to render negligible the small torsion of the current-conveying trailers and the small friction of the jeweled bearings in comparison to the restoring torque. The emf. may then be as large as can be applied to the instrument without endangering the operation of the system by excessive current. This variation in current, or pressure, may be as great as 10 to 1.

This magnetic control gives a rugged and practical system, not only free from variations in pressure of the operating voltage, within the above wide range, but producing a system which gives to the Vawter indicating ohmmeters two distinct advantages over the indicating spring-controlled ammeters and voltmeters in that indications are free from variation in the torsion of the control springs and free from the deterioration of the strength of the permanent magnet used. The indications depend upon the flux distribution and not upon the total flux.

The manner in which this flux distribution is attained is unique and capable of exact adjustment, and renders possible a uniform scale, and in conjunction with the relation and configuration of the resistances, gives any desired range for the indications of the instrument.

The instrument is practical in every particular. It is aperiodic, or dead beat, and does not require any adjustment of a magnetic shunt or a preliminary calibration.

The types designed for the measurement of resistances from one ohm up are self contained, and the small flash-light batteries are easily replaceable. The small intermittent current used to operate the instrument renders the battery life nearly as long as if left inoperative.

The Vawter Indicating Ohmmeter.

The instrument is being manufactured in more than eight different types in order to meet every requirement of resistance measurment from microohms to megohms; from any accuracy to one as small as 1-10 of 1 per cent; from any value to another value as close as 10 per cent greater for the entire scale range; from carrying a negligible current to measuring resistance while carrying full current or overloaded.

One type of the instrument has a switch marked "MULT" which can be set at several different positions marked, for example, .1, 1 and 10, thus giving the scale a range of 1-10 of, equal to, or 10 times, its graduated values. These multiples can be adjusted to have other values than decimals if desired.

Another type has an adjustable rheostat that can be set on any one of ten points marked 0, 100, 200, etc., to 900, which, in conjunction with the scale, enables one more significant figure of the resistance to be read and is thus equivalent to an indicating instrument with a scale ten times as long as it is possible without this attachment. As an example, a resistance to be measured is connected between "LINE" posts. When index stands on scale and is observed to read 47.5 and rheostat 700, the resistance being measured is then 747.5 ohms.

By including a balancing cell between two additional binding posts, electrolytic conductivity or the resistance of batteries may be measured. These additional binding posts are short circuited for ordinary resistances that contain no source of emf.

The fall-of-potential method is employed for measuring low resistances. One application of this type of instrument is to measure the resistance of a section of an electric rail containing a bond in terms of one foot of the solid rail that is bonded. Another type of this low-resistance instrument, used in conjunction with the ordinary current carrying shunts, indicates the resistance of the transformer, armature, or field coils, of low resistance, while carrying current. Its indications being independent of variations in the current over a wide range, as described above, it will also indicate changes in resistance due to current heating effects.

Another type of this instrument is designed to indicate the resistance of incandescent lamps while burning, and of other comparatively high resistances while carrying current under operative pressure.

A type of this instrument especially designed for the adjustment of coils of a definite value to within 1-10 of 1 per cent accuracy is arranged to have a standard resistance inserted, to

whose value the coils are to be adjusted.

In adjusting or checking resistance values of any portion of an electrical apparatus designed to carry current, there is a type of these instruments, or a set of them, that will meet every requirement. The facility of their operation, which saves much time and consequently continuous expense, makes them a valuable addition to electrical measuring instruments.

For testing electric circuits, whether in a coil or a line conductor, they at once tell exactly what the trouble is and where it is. For example, 700 ohms. Using an ohmmeter with a range of from 0 to 1,000 ohms a coil of one motor reads approximately 700 ohms; it is good, if a little high. Probably the coil is a bit warmer than when previously measured, or if a little low, a bit cooler. Another coil reads zero; it is short circuited. Another reads 350 ohms; it is shorted in some manner so as to cut out half of the coil. Another indicates an infinite resistance; it is open. For infinite resistance the index flies off the scale or reads 1,000 ohms when 1,000 ohms is paralleled with the field coil on closing a switch fixed on instrument for that purpose. On grounding one terminal of instrument and connecting the other, first to one terminal, then to the other terminal of the coil, the instrument reads, first 310 ohms, and then 410 ohms; the coil is grounded ¾ of its length from the first terminal and the ground has 10 ohms resistance. If it indicates infinite resistance there is no ground. If it indicates zero and 700 ohms it is grounded at the first terminal, etc.

There is still another type of the instrument used with temperature bulbs in which the scale is graduated in degrees C. or F. for temperature indications.

The applications are unlimited, as its range and accuracy can be made to meet any requirements.

For insulation tests of one or two thousand megohms it can be used with sufficiently high battery or generator voltage, but as a new type of high D. C. voltage supply is being perfected these high ranges are not to be supplied at present unless an external source of high D. C. voltage is available.

To summarize, the instrument is just as simple, reliable, rugged and accurate as the best ammeters and voltmeters, with the added qualities of being independent of spring-control variations and the deterioration of the strength of the permanent magnet.

The complete line of instruments is to be manufactured by the Thompson-Levering Company of Philadelphia, Penna.

Telephones in the Moving Picture Theatre

The time and effort saving qualities of the inter-communicating telephone, which have caused it to be looked upon as almost indispensable by progressive business houses, recommend its use in motion picture theatres. Many of the larger theatres have already installed it.

Responsibility for an efficient, smoothly functioning organization, devolving, as it does, upon one office, that of the house manager, the practically instantaneous touch with various members of his staff afforded him

The Theater Manager's Telephone Equipment.

by the Stromberg-Carlson inter-communicating telephone proves of incalculable benefit.

Countless times during the performance hours he has occasion to communicate with the box office, operating booth, floor captains, orchestra pit, music room, electrician and doorman. Frequently the need is urgent; requires haste. Pressure on a single button gives him almost immediate communication with the desired party, saving him endless steps and much valuable time.

IN CASE OF CROWDS

Take into consideration some of the advantages that accrue to the management with a Stromberg-Carlson inter-communicating telephone system installed in the theatre at each location mentioned. Theatre is crowded, every available seat taken and fire laws forbid standing. The manager first telephones the box office to stop selling tickets. Then, possibly, he notices a number of people leaving and telephones the main floor captain and the balcony captain requesting the number of vacant seats on the main floor and balcony. He receives his answer immediately and in turn advises the box office and the doorman the number of people to be ad-

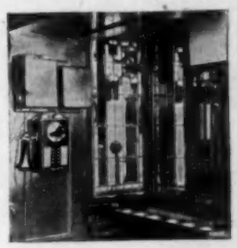
The Operator.

mitted to the unoccupied seats. It is immediately seen that 100 per cent efficiency is gained in the seating capacity of the theatre without the loss of time; where if it was necessary for the house manager or some employe to make this investigation by personal observation and return to the box office with the information considerable time would elapse.

Again the theatre is crowded and the house manager notices that there is a large crowd awaiting admittance —so he immediately telephones the operator, ordering him to abandon all special features and run only the feature films. This of course is giving especially good service to the patrons of the theatre without any loss of time. The majority of the people in the theatre and those waiting for admittance have been attracted by and are interested in the feature films.

FOR LOCATING PEOPLE

It is a common occurrence to receive a telephone call at the box office for a certain doctor or any other person who is known to be in the theatre. In such cases it is only necessary for the box office or house manager to telephone the operator to run a slide at the end of the reel then showing, to inform the desired person



In the Lobby.

that his presence is desired at the box or house manager's office.

TO GIVE DIRECTIONS

The house manager for some reason wishes to change the music either during the period the orchestra is playing or when the majority of the members of the orchestra are in the music room. In this case it is only necessary for him to telephone the leader in either the orchestra pit or the music room and give what orders he deems advisable.

Although there are usually duplicate projecting machines in the operating room, many occasions arise when it is essential that the operator get in touch with the electrician immediately and the use of a telephone in this instance is absolutely indispensable.

HURRY-UP CALLS

If the house manager wishes to change the electrical effects either in the theatre or outside of the building during the period that the show is in progress, or if something has gone wrong with the lighting system it is only necessary for him to telephone the electrician and have such changes or repairs as are required made promptly.

To the house manager will naturally arise thoughts of many other situations in which he and his employes can use an inter-communicating system.

The advantages outlined in the preceding paragraphs cover only the period the theatre is open to the public, but there are just as many advantages to be derived from the house telephone system during the period before and after the theatre is open.

FOR THE SMALLER THEATRE

The foregoing outline covers the number of stations required in the larger theatres, but the manager of a smaller theatre will find that he can manage his theatre on a more efficient and economical basis if he, too, will install an inter-communicating telephone system, using, possibly, a fewer number of stations, at such locations as he deems advisable.

MOST SUITABLE TYPE

The type of system generally recommended to be installed to give this service is commonly known as a selective-ringing, common-talking intercommunicating telephone system and derives its name from the fact that each telephone in the system is equipped with a number of push buttons for signalling the other stations selectively. By depressing the button marked with the name or number of the station wanted, the bell of that station is rung. No other station in the system will be signalled but the one desired, and as a consequence each station may call and talk with any other without interfering with the remaining stations. Any or all stations may be called in rapid succession for the purpose of giving general instructions or conversations involving the attention of those responding to the general call.

The Organist.

The words "common-talking" are derived from the fact that all conversations are carried on by means of a single pair of talking circuit wires which are common to all stations.

MAINTENANCE COST LOW

One centrally located set of about six cells of dry batteries is required to supply both talking and ringing current for this type of system. The exact number of cells required of course depends upon the length of the line. These dry batteries should last, under normal conditions, for a period of at least a year, so that the maintenance in such a system, when once properly installed, amounts to very little. This of course is not counting the depreciation on the system, but when it is figured that such a system, using a good quality of apparatus properly installed, should last for at least 15 to 20 years, the depreciation is a small item.

To insure satisfactory and continuous service of inter-communicating telephone systems the apparatus and material should be carefully selected, but the importance of having the proper installation work done cannot be too strongly emphasized. No matter how excellent the apparatus may be there will be constant operating trouble and expense for repairing unless the installation is made in a thoroughly workmanlike manner, with connections properly and securely made. Dealers who sell Stromberg-Carlson apparatus are qualified to provide proper and satisfactory installation.

The Electrician.

$5,000 Prize Contest for Columbia Battery Dealers

The National Carbon Company, Inc., of Cleveland, Ohio, has designated the month of May as "Hot Shot Battery Month," and during this period is stimulating the interest of dealers by offering $5,000 in cash prizes for the best window displays of Columbia Hot Shots. There will be 124 prizes in all, ranging from $25 to $200, and it is expected that many original and effective displays will be made. Awards will be made from photographs submitted, and the judges will be well-known advertising and window display experts.

This contest is only one phase of a well-planned series of campaigns that will advertise Columbia dry batteries throughout the year. February, March and April were the concentration months for the spring farm-power campaign, taking in every form of gas-engine ignition on the farm, from tractors to cream separators. The advertisements in magazines and farm papers, in both illustration and copy, drew a simple analogy between "oats for old Billy" and "a Columbia Hot Shot for the tractor." This was backed up by billposting in about a thousand county seats of the country.

The motorboat campaign began in April, and will extend through the open-water season. This will feature the Columbia multiple battery, which, being sealed in a waterproof metal container, is specially designed to prevent ignition difficulties afloat. The advertising will be stressed in motorboat journals and the newspapers of cities where water life is a part of pleasure and profit. The same story will be told by billposting in some 500 United States and Canadian cities that border on the water. In newspaper advertising motorboat owners will be told the names of local dealers who carry the Columbia multiple battery.

A campaign is at present stirring up the householder to put in new batteries for doorbell and dining-room buzzer during the spring houseclean-

ing. This is to create a demand more especially for the No. 6 dry cell, but it will also sell Columbia Hot Shots for opening apartment-house doors and other work demanding more cell-power. This campaign will be concentrated in centers of population, and the magazine advertising is supplemented with that in newspapers and on billboards.

The vacation campaign will run through June, July and August. On account of the large amount of juice packed away in the Hot Shot, it is just the battery to use with a portable lighting system in the summer camp. The campaign will cover the nation's vacation centers.

Later in the year there will be another farm-power campaign, when the farmer is filling his silo, cutting wood, and using his stationary gas engine and tractor for the myriad things he must do before snow flies. Last of the seasonal campaigns is that which will sell Hot Shots and No. 6's for Christmas-tree lighting and the operation of mechanical toys.

A campaign began in March, and will run through the year, to educate Ford owners up to the fact that, with a Hot Shot Battery hitched to the engine, it will not be necessary to give more than one turn of the crank to start it. A battery of special size to fit under the seat has just been made for Fords.

Striking and attractive window-display materials are being furnished to all those who have signed up as team workers in these campaigns, so that a close liaison is maintained between the dealers and the advertising.

American Ever Ready's Eastern Sales Manager

The American Ever Ready Works of the National Carbon Company at Long Island City announces the appointment of H. S. Schott as eastern sales manager, effective April 1. Mr. Schott's promotion is a good example of the company's policy of promoting men to executive positions from inside the organization.

Mr. Schott came with the company in 1913 as a clerk and became a successful salesman. He was transferred to the Canadian Ever Ready organization where he became assistant sales manager and made a record which placed him directly in line for the opportunity in this country. Mr. Schott succeeds J. H. Sommers, resigned.

Stromberg Advertising Manager Changes

Mr. W. C. Freeman, advertising manager of the Stromberg-Carlson Telephone Manufacturing Company, with which he has been associated since 1909, resigned May 1, to become advertising manager for the Yawman and Erbe Manufacturing Company of Rochester, manufacturers of "Y and E" filing cabinets and office-system devices. Mr. Freeman got his start with Stromberg-Carlson as a sales correspondent, and after a short time became one of the Company's traveling salesmen. Subsequently he was placed in charge of the branch office at Toronto, where he remained for two and one-half years, doing much important work in developing municipal telephone systems and also

W. C. Freeman.

working in connection with the application of the telephone for load dispatching on high-tension power-transmission systems. Upon returning from Toronto, Mr. Freeman acted as sales engineer in charge of sales to the United States Army and Navy, and other government departments. In 1915 he was appointed advertising manager, and remained in that capacity until leaving. The field is well acquainted with the excellent advertising copy and literature prepared and distributed under the direction of Mr. Freeman. We hate to see him go, but it is a big step forward and we all wish him every success. Mr. Warren Eastwood succeeds Mr. Freeman as advertising manager.

New Company to Develop Automatics Abroad

H. L. Gary, vice president and treasurer of Theodore Gary & Company of Kansas City, Missouri, announces that the syndicate consisting of Theodore Gary, A. F. Adams, H. L. Gary and F. H. Woods, which owns and controls the International Telephone Sales and Engineering Corporation, of New York, and its manufacturing subsidiary, the Automatic Electric Company of Chicago, Illinois, has, together with J. B. Russell of New York, and James Taylor and D. Sinclair of London, (who are well known in connection with the British Insulated & Helsby Cables, Ltd., of London, and various other British corporations) organized the International Automatic Telephone Company, Ltd., of London, and through it purchased the control of the Automatic Telephone Manufacturing Company of Liverpool; and that a substantial amount of new capital has been advanced by the syndicate for the new International Company to be used in the extension of the Liverpool Company's factory so that the manufacture of Automatics can be carried on on a large scale. The Liverpool Company has since 1912 manufactured Automatic telephone apparatus under license from the Automatic Electric Company of Chicago.

The Liverpool organization remains unchanged, and manufacture will proceed on the same lines as formerly, but the new arrangement will enable customers to benefit from quantity production of Automatic telephone equipment. This interlocking of interests through the International Telephone Sales and Engineering Corporation, of New York, and the International Automatic Telephone Company, Ltd., of London, will make available for Strowger business throughout the world the large staff of engineers controlled by the Automatic Electric Company of Chicago, which staff were inventors of the Automatic telephone.

Mr. Gary also states that arrangements have been made by which the Western Electric Company, Ltd., of London, has undertaken under license the distribution of Strowger Automatic equipment, as manufactured at Liverpool, in certain territory throughout the world outside of the United Kingdom of Great Britain and Ireland, also outside of the United

States and other territory in which the International Telephone Sales and Engineering Corporation of New York and the Automatic Electric Company of Chicago, do business, and also outside of territory covered by license given by the Automatic Electric Company of Chicago, to Thomson-Houston of Paris, France.

Theodore Gary & Company of Kansas City, which are the syndicate managers, have for many years been prominently connected with large Independent exchange and long distance telephone properties in the United States, and also with various other enterprises. The officers of Theodore Gary & Company are Theodore Gary, President; A. F. Adams, vice president; H. L. Gary, vice president and treasurer, and C. A. Bennett, secretary. A. F. Adams has just returned on the Mauretania from a nine months' trip to Europe where he has been conducting the negotiations now concluded. Theodore Gary, who is now in England, will remain abroad for some months in connection with the business of the new enterprise.

Texas Ass'n Re-Elects E. C. Blomeyer Head

E. C. Blomeyer of Waco, president of the Texas Telephone Company, was re-elected president of the Texas Independent Telephone Association for 1920, and other officers, most of them to serve another term, were named at the final session of the fifteenth annual meeting of the organization at Dallas, March 19. Other officers elected were as follows: Vice-presidents, A. J. Combs of Haskell, general manager of the Haskell Telephone Company, and J. Y. Rust, San Angelo, president of the San Angelo Telephone Company; treasurer, J. C. Paxton of Sherman; secretary, Oscar Burton of Tyler, assistant manager of the Gulf States Telephone Company, and assistant secretary, G. B. Foscue of Waco.

Seven members of the board of directors also were chosen, to include R. B. Still of Tyler, general manager Gulf States Telephone Company; L. S. Gardner of Waco, auditor Texas Telephone Company; R. W. Cole of Franklin; C. A. Shock, Sherman, secretary and treasurer of the Western Telephone Company; John A. Stratton of Dallas; C. D. Longserre of Bardwell, manager Bardwell Telephone Company, and Merton Swift of San Marcos. An executive board will be named by the officers and directors of the association at a later date.

Included in business of the convention was the adoption of resolutions, of which one concerning the League of Texas Municipalities and a proposed state public utilities commission was adopted. The resolution placed the convention of telephone men on record as opposing any action of the League of Texas Municipalities designed to foster a utilities commission in Texas for the purpose of giving to large cities control of utilities within their domains, which at the same time would put every small utility in the state under the control of state regulation. The resolution, which was presented by R. B. Still of Tyler as chairman of the resolutions committee, also put the convention on record as denying that the Texas Independent Telephone Association had at any time sought to bring disorder into the ranks of public officials now fostering the principle of a Texas public utilities commission.

Plan of the Texas Independent Telephone Association to increase its membership throughout the state by a series of district meetings was discussed at length by the convention, and definite plans put under way for telephone conventions during the coming year in every part of the state.

W. S. Vivian, secretary and treasurer of the United States Independent Telephone Association, who addressed the convention twice during its sessions, told delegates that it is probable that the next national gathering of the United States independent telephone men would be held in Texas.

More Capital Is Ohio Convention Topic

The silver jubilee convention of the Ohio Independent Telephone Association was opened at the Hartman hotel in Columbus, March 25.

Need of additional capital for extension of the business was one of the topics discussed. The unparalleled growth of many Ohio cities in recent years has caused heavy outlays by telephone companies to keep up with the demand for service, according to Frank L. Beam of Mt. Vernon, president of the association since its organization here 35 years ago, making necessary more money in the way of invested capital to take care of extensions and improvements. The question of rates was also discussed.

Requests for increased rates are now pending in many Ohio cities and towns.

Telephone companies owe the community an obligation in furnishing the best telephone service and courtesy financial and industrial conditions will allow, J. W. Safford, Troy, told members of the association.

Safford declared the community too has an obligation to the telephone companies which is to pay a reasonable amount for service to maintain the company's property and enable them to pay adequate wages to employes.

Farmers are insisting upon telephone equipment and service as efficient as that provided for business men in cities, according to reports made at the convention.

The need of continuing schools for instruction of telephone employes was pointed out at the closing meeting. The concensus of opinion was that it paid to have group meetings of operators and exchange managers from nearby places from time to time, even though those who attended such schools of instruction were paid their regular salaries. Technical discussions took place regarding the maintenance of telephone property, operation and systems of accounting yesterday.

All directors, headed by Frank L. Beam, Mt. Vernon, were re-elected.

More than 400 persons attended the convention.

Germany Will Levy Big Telephone Tax

The German government hopes to raise 1,000,000 marks by unusual levy on telephone subscribers. It is announced that they will be assessed a special one-time tax of 1,000 marks which will bear interest and be returned when the subscription is cancelled. Charges for the use of telephones will be more than doubled and postage rates increased 100 per cent in April. Telegraph rates will be heavily advanced.

Tests of the wireless telephone between Berlin and Karlsberg, Sweden, 435 miles, and between Berlin and moscow, 1,055 miles, have proved successful, according to accounts of the tests in the press.

Public Utility Commission News

Reports Concerning the Activities of State Authorities in the Telephone Field

Illinois

The state utilities commission has extended to May 31, 1920, the existing telephone rates charged in Peoria. Anticipating such action, the telephone company has collected the present rate which was first authorized under the administration of Postmaster General Burleson to December 1, 1919.

The commission has issued an order re-suspending until September, 1920, the proposed increase in rates for telephone service in Rockford, Durand and Rockton of the Winnebago County Telephone Company.

The commission issued an order authorizing the Uramgo Telephone Company to increase its rate in Ursa, Loraine, Lima and Tioga, effective April 1.

By permission of the public utilities commission the Schuyler Telephone Company, operating the Rushville city exchange and a number of country lines, has been permitted to increase its rates, effective April 1.

The present and proposed schedules of rates follow:

	Old.	New.
Individual line, business	$25.00	$30.00
Individual line, residence	15.00	21.00
2-party line, business	21.00	24.00
2-party line, residence	13.00	19.00
4-party line, residence	12.00	17.00
Extension, business	4.00	6.00
Extension, residence	2.00	6.00
Desk sets additional	2.00	3.00
Rural line, Rushville	15.00	19.00
Rural line, Camden	11.00	18.00
Rural line, Littleton	12.00	15.00
Switch service sta., 1 ex.	1.50	6.00
Switch service sta., 2 ex.	1.00	2.00

A discount of seventy-five cents per quarter applies to the rates for business and residence telephones if payment is made quarterly at the office of the company on or before the fifteenth day of the first month in the current quarter.

A discount of fifty cents per quarter applies to the rates for rural party line telephones if payment is made quarterly at the office of the company on or before the fifteenth day of the first month of the current quarter.

A discount of $3.00 per annum applies to the rate for rural party line telephones if payment is made annually at the office of the company during the first three months of the calendar year.

Indiana

Purdue University fraternities must pay $3 a month for their telephone service instead of $2, the regular home rate, this figure having been agreed on at a conference of the Lafayette Telephone Company's representative and the fraternity men. J. W. McCardle, of the Indiana public service commission was present at the meeting and approved the agreement. The telephone company sought to make the fraternity pay the regular business rate of $3.50 a month, but the public service commission refused the request.

The commission has granted the petition of the Marietta (Shelby county), Telephone Company for an increase in telephone rates. The present rate is $1 a month. An increase from 50 cents to $1 has been granted.

The public service commission has issued an order authorizing the merger into the Indiana Bell Telephone Company of the Citizens' Telephone Company, of Kokomo; Indiana Union Telephone and Telegraph Company, United Telephone Company, of Bluffton, and Southern Telephone Company of Indiana, Evansville. This order brings into one organization all Bell Telephone properties in the state

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Five telephone companies were authorized to establish increased exchange rates, as follows: Cicero Telephone Company—Business, $1.75; indiviual residence, $1.50; party residence, $1.25. Fishers Telephone Company—Business, $2; individual residence, $1.50. Gaston Home Telephone Company—Business, $2.25; individual residence, $1.75; party residence (town and rural), $1.50. White Star Telephone Company, Westfield—Business, 1.50; individual residence, $1.25; party residence, $1. Shannondale Telephone Company—Business, $1.75; individual residence, $1.50; party (town and rural), $1.25.

A suit for an injunction against the Public Service Commission of Indiana, the Central Union Telephone Company and the Indiana Bell Telephone Company was filed in Circuit Court by T. Ernest Maholm, general counsel for the Telephone Patrons' Union of Indianapolis. The Patrons' Union seeks to prevent the telephone companies from continuing to collect a new schedule of rates granted the companies by the Public Service Commission on February 9, and placed in effect on March 1.

CONTENTION OF PLAINTIFF.

The Patrons' Union asks that the order of the Public Service Commission be considered null and void and set aside because the Central Union Telephone Company was not a corporation organized and existing under the laws of the state of Indiana and, therefore, not under the jurisdiction of the Public Service Commission. The union also contends that the Indiana Bell Telephone Company was organized under the laws of the state after the petition had been filed with the commission and, therefore, failed to come under the jurisdiction of the Public Service Commission. The new rates were characterized in the complaint as being unreasonable, excessive and unlawful.

Mr. Maholm, attorney for the union, stated yesterday: "If the court sustains us in our contention in the case we will then attack the merger of the Central Union Telephone Company and the Indianapolis Telephone Company on the same grounds."

Alleging that the new rates of the Central Union Telephone company are "discriminatory, unreasonable, unlawful and unjust," the city of Muncie, in a complaint filed in the circuit court in which the Public Service Commission of Indiana is the defendant, asks that the judgment and order of the commission granting new and increased rates be set aside. The city contends that the increase was unreasonable, inasmuch as evidence introduced at the hearing familiarized the commission with the poor service rendered by the company to its local patrons.

The public service commission has again established rates for the Ft.

Wayne Home Telephone Company, which were in existence before the Burleson rates were made effective last June, except in one instance. The new rates are made effective at once.

Individual business telephones are charged for at the rate of $3.50 a month. The Burleson rate was $4 a month and the prewar rate $3 a month.

The commission observes in its order that Ft. Wayne now has the lowest telephone rate of any city of like size in the United States. The rates are lower than many Indiana cities of less population, it is declared. The company had petitioned for an increase of $1 for individual business telephones and 50 cents for party business telephones, over the Burleson rates. The city had objected, and the decision is regarded as a victory for the city.

The commission in a supplemental order will fix rates for the company at New Haven, having to do with the giving of free service to the city and city employes.

"The financial success of this company has been unequaled in the experience of the commission, by any company of similar size in Indiana," the order of the commission says. "The record of the company's operation justifies the conclusion that until a recent change in management the property was operated with little regard or appreciation of the company's obligation as an agency of the public service."

The new rates are expected to yield a 7 per cent return on a valuation estimated by the company of $1,181,300.

Frank Wampler, vice president of the Indiana Bell Telephone Company, which will absorb all the Bell systems in Indiana, paid to the Public Service Commission the $30,000 fee in connection with the sale of all the Central Union Telephone Company property in the state to the Indiana Bell. This is the largest fee that has ever been collected by the commission under the Indiana law which requires an assessment of 15 cents on the $100 for the total securities of new utility organizations. Throughout the year 1919 the commission collected only $24,851 in such fees. The Indiana Bell fee was based on securities amounting to $20,000,000.

Within a few weeks the property of the Southern Telephone Company of Indiana, the Indiana Union Telephone Company of Fowler, the United Telephone Company of Marion, Bluffton, Huntington, Hartford City and Montpelier will be merged with the Indiana Bell.

Otto Cloud and T. Y. Savage were authorized to purchase the capital stock of the Funston Telephone Company for $9,000. New rates established include charges of $1.45 a month for individual line service and $1.25 for party lines. Rural service rates will be based on distance from exchange.

The Public Service Commission in an order issued yesterday in the United Telephone Company case denied increases in rates in Huntington and Bluffton. In these cities the commission continued in effect the rates established last June by the Postmaster General during the period of Federal wire control.

The company, however, was authorized to increased its rates at Marion, Hartford City and Montpelier over the Federal rates now in effect.

The new rates for these cities follow:

Marion — Single line business, $4.50; two party business, $3.75; single line residence, $2.50; two party residence, $2; four party residence, $1.75; rural business, $3; rural residence, $1.75.

Hartford City—Single line business, $3.50; two party business, $3; single line residence, $2.25; two party residence, $1.75; rural business, $2.50; rural residence, $1.75.

Montpelier—Single line business, $3; two party business, $2.50; single line residence, $2; two party residence, $1.50; rural business, $2.25; rural residence, $1.65.

The tentative values on the various properties fixed by the commission are: Marion, $490,000; Bluffton, $100,000; Huntington, $280,000; Montpelier, $45,000; Hartford City, $95,000; toll property, $150,000, total exchange property, $1,010,000 and total property, $1,160,000.

The public service commission authorized the Central Union Telephone Company to issue $2,250,000 of 7 per cent serial notes, $375,000 of which will be due on October 1, 1921, and a like amount each six months thereafter until the entire amount is paid. The issue is part of the $4,250,000 the Central Union Company is to pay for the Indianapolis Telephone Company.

The commission has authorized the Mitchell Telephone Company to increase its rates. The primary rates are as follows: Single line business telephone, $2.75 or $2.50, depending upon the kind of instrument used; single line residence telephone $2 or $1.75; single line rural telephone $2.75 and 25 cents for each one-quarter mile beyond the city limits.

The commission directed the Harrison township telephone company, of Clay City to re-arrange its party lines by June 1, so that not more than ten subscribers will be on one line. The board also authorized the company to increase its rates from 50 cents to $1.

The commission has authorized the Laporte Telephone Company to increase exchange rates at Laporte, Wanatah, Lacrosse, Westville, Union Mills, Wellsboro, Rolling Prairie and Hanna. The new net rates for Laporte are: Business, $3.50; individual residence, $2; two-party $1.75; four-party, $1.25; rural party business, $2.50; party residence, $1.75; resorts, $2. Individual rural rates will be based on the city rate, with a line charge of 25 cents for each one-fourth mile beyond the city limits. The rates for the other towns served by the company are: Individual business, $2.50; individual residence, $1.75; rural party business, $2.50; rural party residence, $1.75. All the rates are for "wall" sets. Desk sets are 25 cents higher. In the event of delayed payment of bills, 25 cents a month may be added. The new rates are intended to give a return of little in excess of 5 per cent on the value of the property, which the commission accepted as being worth $435,000.

The commission authorized the West Point Co-operative Telephone Company to charge new rates for telephone service, the individual line rates being $2 for business, $1.50 for residence and $1.75 for rural, plus 25 cents for each quarter of a mile beyond the city limits.

Louisiana

The Shreveport Home Telephone Company's application for a raise in its rates from $3 per month to $4 for business telephones was granted by the State Railroad Commission. Application for the increase was at first refused but on further hearing the increase to apply to business telephones only was allowed.

Missouri

The Missouri public service commission authorized the Southwestern Bell Telephone Company to increase its capital stock from $30,000,000 to $200,000,000 for the purpose of taking in the Oklahoma and Texas Bell companies. All systems are owned by the American Telephone and Telegraph Company.

Of the authorized capital stock only $60,000,000 in common stock is to be issued at present. Half of this will be to retire the Southwestern stock and the other half to retire the stocks of the Oklahoma and Texas companies.

New York

Managers of several hotels in New York City announce that they will not reduce their telephone rate from 10 cents to 5 cents until they have legally advised to do so, in spite of the decision of the Public Service Commission of the second district, rendered in Albany, forbidding hotels and apartment houses to fix rates for service other than those on file with the commission. It was estimated that about 100,000 calls are sent daily from the hotels at the 10-cent rate. A 50 per cent reduction would mean an aggregate loss of about $5,000 a day to the hotels.

Charles J. Campbell, counsel for the Hotel Men's Association, said he understood that the telephone company is allowed till May 1 to file a new schedule, effective on June 1, and that the present rate would continue until then. If the telephone company could make contracts with the hotels to enable them to sell calls at 5 cents, he is sure the hotels would be glad of it. At present, with the investment in wiring and special service given guests, the hotels cannot afford the reduced rate, he pointed out.

Ohio

Telephone service in Cleveland will be investigated further by the state public utilities commission before a decision is given in the city's application for improved service and lowered rates.

Columbus, March 30.—The Ohio State Telephone company was authorized by the state public utilities commission to increase rates in Dayton, Youngstown, Alliance, Hubbard, Salem, Lisbon, East Palestine, Columbiana, Rogers, New Waterford and Leetonia, in accordance with its schedule filed with the commission several weeks ago. The new rates became effective April 1.

Law Director Martin, of Toledo, may apply to the State Public Utilities Commission for a modification of the increased rates granted to the Ohio State Telephone Company, unless service improves by May 1, when the new rate is effective, he said.

In granting an increase in rates in the Toledo field to the Ohio State Telephone Company, the commission says the Home company operates more economically than the Bell company.

The commission refused to allow the Home company to increase its rates in the same amount as recently granted the Bell company. To have done that, under the circumstances, the commission said, would have been to give the Home a return of 7.71 per cent on its investment. The rates fixed will limit the return to 6.81 per cent.

Increased Bell Telephone rates were authorized by the state utilities commission, effective April 1, in Akron, Dayton, Springfield, Youngstown, Toledo, Columbus and Zanesville. In asking for the boosted rates, the Central Union Telephone Company declared they are necessary in order to prevent employes from being enticed by the higher wages offered by industries not regulated.

The biggest increases affect business telephones. The commission believes the unprecedented demand for telephone service is due largely to the industrial and commercial activity of the nation and the ever increasing use of the telephone in business transactions.

The problem of determining just rates was complicated by the interweaving of the business of the Central Union with that of the American Telephone and Telegraph Company. The Central Union operates local exchanges in Ohio, Indiana and Illinois. The other company is a New York corporation engaged in long distance business.

The commission declared that, although the Central Union Company has a $5,000,000 deficit and owes the other company over $43,000,000, the net earnings of the New York corporation last year totalled $60,000,000, including $35,000,000 in dividends.

Central Union Telegraph Company rates in Columbus, Akron, Dayton, Springfield, Youngstown, Toledo and Zanesville increased under authority of a decision handed down by the state public utilities commission.

The increases allowed are considerably below the rates fixed in schedules filed by the companies. They are allowed to meet increased wages which the company has been obliged to pay to retain their operators and compete with unregulated industries, the orders of the company says. Increases are mostly to commercial subscribers.

Pennsylvania

The public Service Commission cannot suspend the proposed increased rental rates of the Bell Telephone Company, which go into effect May 1, or the toll rates effective April 21. On those dates the Bell Company having given 30 days' notice of the increase, can begin charging the higher rates. If later, upon investigation and after hearing, the Public Service Commission finds that the rates are unfair or excessive, reparation to the company's patrons will be ordered.

That information was given out at Harrisburg by W. D. B. Ainey, chairman of the Public Service Commission.

Wisconsin

Scores of complaints from all sections of the state are resulting in adjustments and increased rates for local telephone companies.

By an order issued by the commission the Chetek Rural Telephone Company was authorized to put in force the following new schedule of rates, the increase being granted upon a petition filed with the commission on December 29; business, 1—party $2 net per month, 2—party $1.50 net per month; residence, 1—party $1.50 net per month, 2—party $1.25 net; 4—party, $1.15 net; rural party line metallic, $4.50 net per quarter, grounded line $3.45 net per quarter; switching 40 cents net per month. Bills will be made out for 25 cents per month in excess of the above that amount to be a discount for prompt payment.

An increase from $1.25 per month per subscriber to $1.50 by the Marshfield Rural Telephone Company was authorized in an order issued by the railroad commission. The company operates an exchange at Rozellville

and trunk lines between Rozellville and Marshfield which are connected to the system of the Marshfield telephone exchange. In addition it has a number of lines which are connected directly at the Marshfield board, and which are switched by the Marshfield telephone exchange.

The Union Telephone Company of Plainfield has received notice from the commission that the company's application for an increase in rates has been granted, the raise being effective immediately. The old rate on rural lines was $1.10 a month. The new rate is $1.50. Business telephones were $1.60. They now are $2.25. Residence telephones were $1.35 a month, now they are $1.75.

The railroad commission today handed down a decision in the Barron county telephone case granting an increase in rates of 15 cents per month on all except rural business, and an increase of 25 cents per month in residence rates, and 15 cents per month in rural rates at Rice Lake. The company had asked for an increase at Barron of 50 cents per month in business rates and 25 cents in residence rates, and at Rice Lake for an increase of 50 cents per month in all rates. The company also asked for the right to charge $6 per year more for metallic line service than for grounded line service for rural business and further asked to establish a zone rate on this class of business whereby the subscriber living furthest from the exchange pays more than those subscribers living nearer. Both of these applications were denied as was also the request to limit extensions of the rural lines where the subscriber lives more than eight miles from the central office.

The railroad rate commission handed down a decision changing rates on telephone service connections, change of name charges, as well as charges for moves in type of equipment.

Installation charges for an individual party line, according to the new schedule, must not exceed $3.50; an extension station, $3.50; for each trunk line between a private branch exchange and a central office, and for each telephone connected to a private branch exchange with the exception of operators' sets, $3.50 each.

These new rates supersede the war-time schedule promulgated by the postmaster general of the United States.

Minnesota

The Zumbro Valley Telephone Company is authorized to place in effect, as of May 1, the following schedule of rates for local and rural telephone service at Byron, Minnesota:

	Per month
Individual Line Business, gross	$2.00
Business Extensions, net	.50
Individual Line Residence, gross	1.75
Four-party Line Residence, gross	1.50
Residence Extensions, net	.50
Rural Multi-party, gross	1.50
Rural Switching, net	.35

All rates to be billed gross, except where quoted net. A discount of 25 cents to be allowed from the above gross rates if paid on or before the 20th of the month in which the service is rendered, except that multi-party rural rates are payable quarterly in advance, with a discount of 75 cents if paid on or before the 20th of the first month of the quarter; a discount of 50 cents if paid on or before the 20th of the second month of the quarter, and a discount of 25 cents if paid on or before the 20th of the third month of the quarter.

The Nicollet County Telephone and Telegraph Company is authorized to discontinue the operation of its central office in the village of Kasota upon the reconstruction of the outside distributing plant and the arrangement for the service of the subscribers of the Kasota exchange over lines directly connected with the central office of the St. Peter exchange.

The Norman County Telephone Company is authorized to place in effect, as of May 1, 1920, the following schedule of rates for local and rural telephone service at Ada, Minnesota:

	Per month
Individual Line Business, gro.	$2.75
Two-party Line Business, gro.	2.00
Business Extension, net	.50
Individual Line Residence, gross	1.50
Residence Extension (with bell) net	.25
Residence Extension (without bell), net	.12½
Rural Multi-party, gross	1.50
Rural Switching, net	.25

All rates to be billed gross except where quoted net; all rates payable in advance with a discount of 25 cents per month if paid on or before the 10th of the month in which the service is rendered, except that rural multi-party rates are payable quarterly in advance, with a discount of 75 cents if paid on or before the 10th of the first month of the quarter; 50 cents if paid on or before the 10th of the second month of the quarter, and 25 cents if paid on or before the 10th of the third month of the quarter.

The Greenfield Farmers Telephone Company is authorized to purchase and the Dwelle Telephone Company to sell all of that telephone property within the city of Wabasha known as the Wabasha Exchange with all lines connecting therewith and tributary thereto, including all poles, wires, conduits, cables, materials, tools and appliances used in connection with the operation of said exchange.

The New Ulm Rural Telephone Company is authorized to place in effect, as of April 1, the following rates for local and rural telephone service at New Ulm, Minnesota:

	Per month
Individual Line Business, gross	$3.00
Two-party Line Business, gross	2.50
Business Extension, net	1.00
Individual Line Residence, gross	1.75
Two-party Line Residence, gross	1.50
Residence Extension, net	.50
Rural Multi-party, gross	1.75
Commercial P. B. X. and Inter-Com. Systems:	
Trunks (two-way), gross	3.00
Stations, net	1.00

All rates to be billed gross except where quoted net, all gross rates to be payable monthly in advance, with a discount of 25 cents per month if paid on or before the 15th of the month in which the service is rendered, except that rural rates are payable quarterly in advance, with a discount of 75 cents if paid on or before the 15th of the first month of the quarter; a discount of 50 cents if paid on or before the 15th of the second month of the quarter, and a discount of 25 cents if paid on or before the 15th of the third month of the quarter.

The Bygland Rural Telephone Company is permitted to establish and

place in effect, as of April 1, a rate of $1.25 per month.

The application of the International Telephone Company to increase its telephone rates at International Falls, Minnesota, is denied.

The Viola Farmers Telephone Company is authorized to place in effect as of April 1, the following schedule of rates for local telephone service at Eyota, Minnesota:

	Per month
Individual Line Business, gross	$2.50
Two-party Line Business, gross	2.25
Individual Line Residence, gross	1.75
Four-party Line Residence, gro.	1.50
Extension Telephones, net	.50
Rural Multi-party, gross	1.75

All rates payable in advance; all rates to be billed gross except where quoted net; a discount of 25 cents per month to be allowed from the above gross rates if the bill is paid on or before the 10th of the month in which the service is rendered except that rural multi-party rates are payable quarterly in advance with a discount of 75 cents if paid on or before the 10th of the first month of the quarter, 50 cents if paid on or before the 10th of the second month of the quarter, and 25 cents if paid on or before the 10th of the third month of the quarter.

The New Richland Telephone Company is permitted to place in effect as of April 1, the following schedule of rates for local telephone service at its New Richland and Waldorf Exchanges:

	Per month
Individual Line Business, gross	$2.50
Two-party Line Business, gross	2.25
Business Extension, net	.50
Individual Line Residence, gross	1.75
Two-party Line Residence, gross	1.50
Residence Extension, net	.50
Rural Multi-party, gross	1.75
Rural Switching, net	.35
Halls, Lodge Rooms and Churches, net	1.00

All rates to be billed gross except where quoted net, all gross rates payable monthly in advance with a discount of 25 cents per month if paid on or before the 15th of the month in which the service is rendered except that multi-party rural rates are payable quarterly in advance with a discount of 75 cents if paid on or before the 15th of the first month of the quarter, a discount of 50 cents if paid on or before the 15th of the second month of the quarter, and a discount of 25 cents if paid on or before the 15th of the third month of the quarter.

The Zumbrota Telephone Company is permitted to establish and place in effect, as of May 1, the following schedule of local and rural telephone rates at Zumbrota, Minnesota:

	Per month
Individual Line Business, gross	$2.75
Two-party Line Business, gross	2.00
Extension Stations, Business, gross	1.25
Individual Line Residence, gross	1.75
Four-party Line Residence, gro.	1.50
Extension Stations, Residence, net	.50
Rural Multi-party, Metallic, gro.	1.75
Rural Multi-party, Grounded, gross	1.50

A discount of 25 cents per month is allowed on the above gross rates if paid on or before the 20th day of the month in which the service is rendered.

The Campbell Rural Telephone Company is permitted to place in effect, as of April 1, the following schedule of rates at Campbell, Minnesota:

	Per year
Rural Multi-party, gross	$16.00
Switching Charge, Town, net	3.00
Switching Charge, Rural, net	2.00

The gross rate to be billed quarterly in advance with a discount of 25 cents per quarter if paid during the quarter in which the service is rendered. The switching rate to be payable annually in advance during the first quarter of each year.

The Dumont Telephone Company is permitted to place in effect, as of April 1, the following schedule of rates for local telephone service at Dumont, Minnesota:

	Per month
Individual Line Business, gross	$2.50
Individual Line Residence, gross	1.75
Rural Multi-party, gross	1.50

All rates payable monthly in advance with a discount of 25 cents per month if paid on or before the 15th of the month in which the service is rendered, except that the rural rates are payable quarterly in advance, with a discount of 75 cents if paid on or before the 15th of the first month of the quarter; 50 cents if paid on or before the 15th of the second month of the quarter, and 25 cents if paid on or before the 15th of the third month of the quarter in which the service is rendered.

The Greenwood Prairie Telephone Company is authorized to place in effect, as of April 1, the following schedule of rates for local and rural telephone service:

FLAINVIEW

	Per month
Individual Line Business, gross	$2.75
Two-party Line Business, gross	2.50
Business Extension, net	.75
Individual Line Residence, gross	1.75
Two-party Line Residence, gross	1.50
Residence Extension, net	.50
Rural Multi-party (Metallic Circuit), gross	1.75
Rural Multi-party (Grounded Circuit), gross	1.50
Rural Extension, net	.50
Rural Switching, net	.50

ELGIN

	Per month
Individual Line Business, gross	$2.50
Two-party Line Business, gross	2.25
Business Extension, net	.75
Individual Line Residence, gross	1.75
Two-party Line Residence, gross	1.50
Residence Extension, net	.50
Rural Multi-party (Metallic Circuit), gross	1.75
Rural Multi-party (Grounded Circuit), gross	1.50
Rural Extension, net	.50
Rural Switching, net	.50

MILLVILLE

	Per month
Individual Line Business, gross	$2.25
Two-party Line Business, gross	2.00
Business Extension, net	.50
Individual Line Residence, gross	1.50
Two-party Line Residence, gross	1.25
Residence Extension, net	.50
Rural Multi-party (Metallic Circuit), gross	1.75
Rural Multi-party (Grounded Circuit), gross	1.50
Rural Extension, net	.50
Rural Switching, net	.50

All rates payable in advance, all rates to be billed gross except where quoted net, a discount of 25 cents

per month to be allowed on all gross rates if paid on or before the 25th of the month in which the service is rendered, except that multi-party rural rates are payable quarterly in advance, with a discount of 75 cents if paid on or before the 25th of the first month of the quarter; a discount of 50 cents if paid on or before the 25th of the second month of the quarter, and a discount of 25 cents if paid on or before the 25th of the third month of the quarter.

Telephone Crisis Is Not Yet Settled

"In the clamor about the proper legislation for the preservation of the railroads after their return to their owners," says Frank O. Cuppy, of Lafayette, secretary of the Indiana Telephone Association, "it should not be forgotten that all the telephone systems of the country, taken over bodily by the government during the war, were turned back on short notice just a few months ago—and without any remedial legislation. The seriousness of the railroad situation cannot be minimized, but the problems of the telephone companies are in their way just as serious."

Pointing out that "there are in this country several hundred thousand citizens with their money invested in telephone properties to an aggregate of over two billions of dollars." Mr. Cuppy declared there are 300,000 persons employed and that about 60 cents out of every dollar of the cost of running the average telephone system goes for wages.

"Those who are engaged in the telephone business are no more immune to the high cost of living than those in other lines of work—and as it has cost them more and more to live, their pay has had to go higher and higher. The equipment and material the companies must buy to keep up their plants has increased in cost from 30 to 300 per cent—an average of perhaps 75 to 85 per cent for the things used most frequently. Sundry expenses have all increased, too; they average around 60 per cent higher than in 1914.

"It has been practically impossible to keep the services up to the pre-war standards in most cases. The difficulty of obtaining labor and materials for maintenance work during the war prevented many companies from maintaining their plants at the old standard. Every telephone company is going to need considerable money during the next year to bring its property back to the old standard of efficiency.

"It will surprise the average citizen to learn that the increases in exchange rates hardly average 20 per cent since 1914. As no utility can manufacture even a reasonably satisfactory service when its income is inadequate for the purpose, the public must look at both sides of the question. The telephone company is possessed of no magic power by which it can obtain present-day labor and meet present-day expenses at pre-war prices. It is not a free agent. Its income is limited by the rates it is allowed, by regulation of public authority, to charge for its services. When that rate is too low, the service must inevitably fall below the standard of efficiency needed and demanded by the American public.

"Telephone service has become too valuable and too essential in our every-day life to allow it to become impaired or less useful when usually so moderate an advance in the cost of service to each user is all that is necessary to keep the business going and the service satisfactory, even in these days of the high cost of living."

Vienna Holds the Palm for Poor Service

Americans who may sometimes be dissatisfied with the telephone, telegraph or postal service in America should try Vienna if they want to see a really disorganized means of communication.

So demoralized is the telephone service of Vienna that a great mass meeting of business men has been held and has demanded that this service be taken from the government bureaucracy and turned over to private control.

It is almost impossible to get central, and, once secured, the line is usually cut after less than a minute's conversation. The telephone employes claim they are overworked, undernourished and the whole equipment run down. The minister of communications admitted to the mass meeting that the telephone and post and telegraph systems generally had failed and that the post office had paid more than 15,000,000 crowns last year for stolen packages. Armed guards are now placed on all mail transport.

The worst factor in the situation is declared to be inability of officials to enforce discipline under the present government where various councils of workmen and soldiers operate to make the employes lax and independent.

One man who attempted to telephone from a postal sub-station was told by the attendant, the other day, to "go to a public automatic station and don't worry me."

Texas Court Holds Company to Franchise Terms

In sustaining a decision of the Texas lower court restraining the Greenville Telephone Company from assessing installation charges. Chief Justice Anson Rainey of the Fifth Court of Civil Appeals held that a franchise holder may not exercise any privileges not granted it in "unequivical terms" under the franchise.

The suit originally was brought by the city of Greenville in the District Court there when the telephone company fixed a charge of $3.50 for installing a telephone and a like amount for moving an instrument. The District Court granted an injunction, and from this decision the telephone company took appeal. It was held by the appellants, among other assignments, that the levy of an installation charge was not prohibited in the franchise, and hence was not a franchise violation. As stated above, the higher court did not concur in this theory.

Interesting items of increased costs are quoted in the opinion as constituting part of the telephone company's defense. It developed in hearing the case on the facts that the following increases in cost of operation have been made since the war: Labor 27 per cent, copper 14, lead 10 and poles 40.

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